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A Review On- Water Quality Measurement System Using Artificial Intelligence

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ABSTRACT

Water is vitally important to every aspect of our lives. Monitoring the quality of the drinking water is essential as polluted water can cause deadly diseases. Usually in conventional water quality measurement systems, complexometric and colorimetric titration methods were being used, which yields results slowly. In this paper different physical and chemical water quality parameters like pH, turbidity, conductivity, total dissolved solids(TDS) and dissolved oxygen etc. are measured using different sensors. The data obtained from these sensors will be sent to the PC (LabVIEW) where this data is analyzed, and the water quality indicators are compared with the reference data provided by Indian Standards Institute (ISI) and Bureau of Indian Standards(BIS) and results are displayed as per the requirement. This paper proposes the technique to combine and infer the multi-sensor data to get the water quality result, by which accurate results can be obtained. As the water quality is subjective by nature and highly indeterminate, which causes uncertainties in the data. To overcome data uncertainties problem, this paper proposes fuzzy logic model for acquiring the accurate water quality.

Keywords: Water Quality, LabVIEW, Multi-Sensors and Fuzzy logic.

I. INTRODUCTION

Clean water is a human right. Pure and safe drinking water is the necessity of each human for the survival. Each human being on Earth requires at least 20 to 50 liters of clean water per day for the survival. The safety and accessibility of water is major concerns throughout the world. Health risks may arise from consumption of water contaminated with domestic effluents, industrial effluents, sewage, agricultural effluents and radioactive wastes etc. So, it is highly advisable to monitor the quality of the water, monitoring the quality of surface water will help us to protect our waterways from pollution. World Health Organization (WHO) and Indian Standards Institute (ISI) provides international and Indian norms on the water quality in the form of guidelines that are used as the basis for framing regulation and to set the water quality standard world-wide. Reference [4] provides the different water quality parameters needs to be maintained in the water, so that it can be used for the human consumption.

In this paper water quality indicators such as pH, turbidity, conductivity, total dissolved solids(TDS) and dissolved oxygen etc. are measured using different sensors. Solutions with the pH of 7 are neutral, whereas solutions with pH above 7 are referred as basic and below 7 are referred as acidic in nature. In Potable water pH of the range 6.5 to 8.5 is acceptable. Dissolved oxygen refers to gaseous oxygen that are mixed in the water, which should be around 5-6mg/l in the potable water. Turbidity is the measure of relative clarity of a liquid, which is

measured by shining a light through the water and is reported in nephelometric turbidity units (NTU). Total Dissolved Solids(TDS), are the solids or substances like minerals, salts, heavy metals etc. that are found in water and some traces of organic matter that are dissolved in water, usually TDS is the main reason for turbidity of the water. Conductivity is a measure of water's capability to pass electrical flow. This ability is directly related to the concentration of ions in the water, by which we can find the salinity of the potable water.

II. LITERATURE SURVEY

Eric et al[1] describes about developing the Autonomous ocean-sampling networks (AOSN) for providing the physical and chemical characteristics of the ocean water, which uses sensors capable of adaptive observations. This paper suggests about joining different sensors to get the unified results. Jyotirmoy et al[2] explains about detecting various water quality parameters using Bio-Sensors, Optical Sensors and Microelectronic Mechanical Systems (MEMS). This paper also explains about combining of newly available sensing technologies in an integrated system to obtain the higher-level sensitivity and also real time data analysis capability. MEMS, optical and bio-sensors provide the accurate reading about water quality parameters, however this technique requires individual power and individual transducer units, by which development of integrated water quality measurement system becomes too complicated. Huaiyu et al [3] describes about the transmitting, compressing and processing the data obtained from sensors by using data fusion method. Raman et al. [9] explains about the certain water quality parameters indication methods using fuzzy logic model and the importance of measuring water quality parameters. Muhammad et al. [5] describes about advantages of modern method of water quality measurement system over traditional method of water quality measurement techniques. Paper also explains about development of an automatic, remote, portable, real time, and low-cost water quality monitoring system using micro controllers and multiple sensors.

III. METHODS AND MATERIAL

Water quality indicators such as pH, turbidity, conductivity, salinity and dissolved oxygen etc. are measured using respective sensors and the measured data will be sent to PC with LabVIEW via DAQ (Data Acquisition) card. In LabVIEW fuzzy logic module will be developed for analysing and comparing the measured data with the reference data provided by the BIS and water quality results will be displayed as per the requirement.

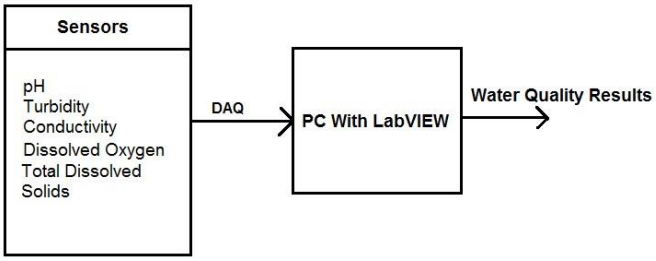

Figure 1. Block Diagram of Water Quality Measurement System

To obtain the accurate and acceptable reasoning, fuzzy logic module will be implemented. Any uncertainties in the engineering will be handled by the fuzzy module in the proposed technique. Fuzzy logic model includes, a fuzzification engine which converts crisp inputs into fuzzy inputs, knowledge-base, which stores the If-Then rules written by the designer. An inference engine will simulate the process to make the fuzzy inference based on the If-Then rules and fuzzy variables such as DO, TDS, TURB and pH. It has a defuzzification unit operative to translate the fuzzy outputs into a discrete crisp value of water quality indicating parameters.

IV. RESULTS AND DISCUSSION

Proposed technique is expected to deliver an automatic, remote, portable and real time water quality determining system. Which will provide the quality of the given water sample within very short

duration compared to titration methods. This technique will be helpful in determining contaminants in the water using different sensors. These sensors are expected to work within their intended accuracy ranges. As water quality is subjective by nature or for which the data is uncertain, wherein target non-linearity in the measured input values can be addressed effectively using fuzzy logic model system to obtain the accurate results.

V. CONCLUSION

Water quality indicating parameters like pH, turbidity, total dissolved solids (TDS), dissolved oxygen and conductivity will be measured using different sensors. In this water quality parameters are measured using multi-sensor technique; Multi-sensor data is combined and inferred to obtain the water quality, which will be more efficient and potentially more accurate than if they were achieved by means of a single sensor/ meter.

Fuzzy logic module will be implemented to overcome the data and engineering uncertainties and to obtain the accurate water quality results.

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