Mobile Sensor Node for Real Time Monitoring of pH Level in Domestic Water Resources

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Abstract— With increased levels of environmental pollution, access to clean water is hampered all over the world. As typical laboratory experiments and official water quality tests take considerable amount of time to obtain results, demand for real time monitoring of pH value in household water is ever increasing. This paper presents a technique implemented based on wireless sensor networks and mobile technologies to measure pH value in water in a domestic environment in real time. The proposed system facilitates storing of monitored records that can be viewed graphically on a mobile phone. Real time measurements taken using three water samples indicate that the system performed with a high accuracy and low transmission delays between the sensor node and the mobile device. The system can be readily implemented as a low cost consumer device that can be used even by non-technical persons.

***Key words*: pH in water, wireless sensor network, water quality measurements**

I. INTRODUCTION

Water is a limited and precious resource not only for human existence but also for flora, fauna and aquatic life. As such, maintaining its quality is essential in order to consume freshwater in day-to-day life. With the industrial development in the modern world, disposal of waste into clean water resources is critically responsible for the reduction of quality of water. Also, pesticides and fertilizers in agriculture too contribute for the destruction of the natural balance, not only in surface water, but also in ground water [1,8].

The quality of water can be measured using several conditions and constituents. These conditions are defined using chemical, physical and biological characteristics of water. One of the main water quality parameter is 'pH', a chemical characteristic used to measure the acidity level of water. It is an indicator of contaminants in water as pH level varies according to the amount of native substances [3].

The process of assuring the quality of water is called water quality monitoring and there are standards for water quality defined by authorized organizations with respect to usage of water [14]. Water quality monitoring is recommended in many situations. Water wells around factories and sites that dump hazardous waste should be regularly monitored [13] as well as water sources in agricultural areas [6, 7]. Moreover, soon after natural disasters such as floods, landslides, tsunami, etc., water sources in the affected area should be tested whether it is suitable for consumption or not [4, 5].

To assure the quality of water, tests can be performed on actual sites and in laboratories [2]. When few measurements are taken at sites, most of the tests are carried out in laboratories by collecting water samples from a particular site and transporting them into different locations. Taking readings in a different environment other than the native environment of the samples will produce error reports hampering accurate monitoring [9].

Although most of these tests are done by authorized organizations having expertise, contacting them and getting necessary authorization involve bureaucracy and cost both time and money. A delay in obtaining the required measurements makes tracking sudden changes in water difficult. In order to prevent disasters based on poor water quality, a technique to monitor water quality in real time over a prolonged time interval is essential. Future risks can only be identified by observing the patterns of collected data over time by keeping a proper storage system.

In Sri Lanka, we have experienced unfortunate incidents where lives of people were lost due to protests over anomaly in pH value in drinking water. This happened because a technique to monitor pH value in real time is not available among an average citizen. Therefore, citizens demand real time information about the quality of water they consume, especially drinking water [1, 2].

In order to solve this national problem, a mobile application based on wireless sensor networks is designed and developed to take real time measurements of pH level in water. It consists of a sensor node that measures pH level in water and communicates with a mobile device via Wi-Fi. An ad-hoc network is setup to send sensed data to a mobile application. Further, the mobile application dynamically displays sensor data in real time and allows us to visualize past data in a graphical form.