# Contamination Detection In Drinking Water

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***Abstract***- *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 micro systems for analog signal conditioning, processing, logging, and remote presentation of data. Finally, algorithms for fusing online multi sensor 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 escherichia coli bacteria and heavy metals (arsenic). Experimental results indicate that this inexpensive system is capable of detecting these high impact contaminants at fairly low concentrations.*

***Keywords***- PIC18F4550, Turbidity Sensor, pH Sensor, Temperature Sensor , LCD Display.

## 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 safe guarding 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. Traditional methods of water quality control involve the manual collection of water samples at various locations and at different times, followed by laboratory analytical techniques in order to characterize the water quality. Such approaches are no longer considered efficient [1]–[5]. Although, the current methodology allows a thorough analysis including chemical and biological agents, it has several drawbacks: a) the lack of real-time water quality information to enable critical decisions for public health protection (long time gaps between sampling and detection of contamination) b) poor spatiotemporal coverage (small number locations are sampled) c) it is labor intensive and has relatively high costs (labor, operation and equipment). Therefore, there is a clear need for continuous on-line water quality monitoring with efficient spatiotemporal resolution. US Environmental Protection Agency (USEPA) has carried out an extensive experimental evaluation [6] 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), Temperature and PH. Thus, it is feasible to monitor and infer the water quality by detecting changes in such parameters. Given the absence of reliable, in-line, continuous and inexpensive sensors for monitoring all possible biological and chemical contaminants, our approach is to measure physicochemical water parameters that can be reliably monitored with low cost sensors and develop low cost networked embedded systems (sensor nodes) as well as contamination detection algorithms to fuse these multi-sensor data in order to infer possible contamination events. Even though this approach may suffer from some false alarms, it can be compensated /eliminated by the large scale deployment and the possibility of correlating the decisions from various sensor nodes which is the topic of our future work. There is a clear need for a shift in the current monitoring paradigm and this paper proposes the idea of monitoring the quality of water delivered to consumers, using low cost, low power and tiny in-pipe sensors.

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## II. LITERATURE SURVEY

Pradhan et al. (Reference 1, Year: 2003): investigated the quality of drinking water used by the communities and their awareness regarding water quality and water borne diseases in Bungamati Locality in Kathmandu Valley, Nepal. The observation indicated that the factors responsible for contaminating drinking water at source points included lack of protection and proper treatment of water, leakage in pipe distribution system, intermittent supply of water, poor drainage system and poor environment surrounding of water sources. So, the drinking water is not potable. The communities are unaware of the quality of water they use. Incidence of water borne diseases appears to be the common health problem among the sample households in the study region. It is found more serious during the dry summer.

Gregor Muri (Reference 2, Year: 2004): studied basic physical and chemical characteristics of the water in 14 Slovenian mountain lakes. Surface water was sampled once a year over three consecutive years (2000-2002). The influences of lake and catchment area properties on the measured parameters were studied. The lake's tropic status and size of catchment area were found to affect the water chemistry. Pearson correlation coefficients were calculated to identify the strength of relation between the variables. The highest correlation was found among the alkalinity, calcium and conductivity. Cluster analysis was additionally performed to obtain natural groupings in the data. Finally, the condition of the lakes was assessed. Although the water quality has deteriorated in some lakes (especially in Jezero na Planini pri Jezeru), most of the lakes are still in a good condition

Wakida and Lerner (Reference 3, Year: 2005): explored for non-agricultural sources of nitrate in groundwater at Nottingham, England. They found that leaky sewers and solid wastes, including landfills,contribute to the nitrate content in the urban aquifer.From a study conducted by Achyuthan Nair et al., (2005) on the assessment of the well water quality of Benghazi ,Libya , recorded very high nitrate contents in some of the well waters ,which are of concern.

Lang et al. (Reference 4, Year: 2006): observed that the major anthropogenic components in the surface and ground water include $K^+$, $Na^+$ ,$Cl^-$ ,$SO_4^{2-}$and $NO_3$ with $Cl^-$ and $NO_3$ being the main contributors to ground water pollution in Guiyang ,China and its adjoining areas. The seasonal variations in concentrations of anthropogenic components demonstrate that the karsts ground water system is liable to pollution by human activities. The conducted water quality assessment in the Densu basin of Ghana between july 2003 and March 2004 and identified human, animal and agricultural activities as the main source of pollution. The dominance of chloride over sulfate was probably due to household effluents, fertilizer use and other anthropogenic point sources.

## III. PROPOSED SYSTEM

The Block Diagram consist of 3 different sensors. Turbidity sensor ,temperature sensor and pH sensor . These consist of PIC, LCD display, Power supply and sensor node network.

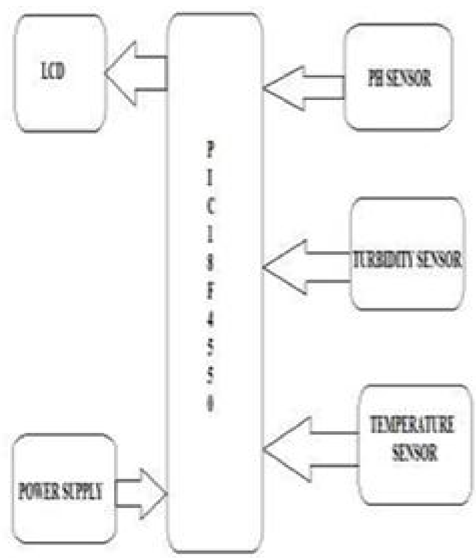


Figure 1: Block Diagram of Contamination Detection Module.

PIC18F4550 is used in which the pH sensor shows the sensor to determine the temperature of water, the turbidity sensor determines the presence of amount of turbidity present in water which is also displayed on LCD. In input we have provided power supply of 5v which works only on 5v.

The pH sensor shows the acidic and basic value determining the water. It ranges from 6.5 to 8.5. It is analog by PIC18F4550 and digital by LCD output. Also we have the temperature measuring sensor which gives the data of water temperature to the PIC18F4550 and displayed out on LCD screen, the turbidity sensor determines whether water is clean or turbid which ranges from 0 to 5 also measures the level of turbidity with help of PIC18F45550 and display over LCD as well. The whole combinations are powered by 5v power supply by which it can run smoothly. acidic value on LCD and also we have used the temperature

## IV. SOFTWARE DEVELOPMENT

MPLABX IDE is a software program that is used to develop applications for Microchip microcontrollers and digital signal controllers. This development tool is called an Integrated Development Environment, or IDE, because it provides a single integrated "environment" to develop code for embedded microcontrollers.

MPLAB X IDE is a "wrapper" that coordinates all the tools from a single graphical user interface, usually automatically. For instance, once code is written, it can be converts into executable instructions and downloaded into a microcontroller to see how it works. In this process multiple tools are needed: an editor to write the code, a project manager to organize files and settings, a compiler or assembler to convert the source code to machine code and some sort of hardware or software that either connects to a target microcontroller or simulates the operation of a microcontroller.

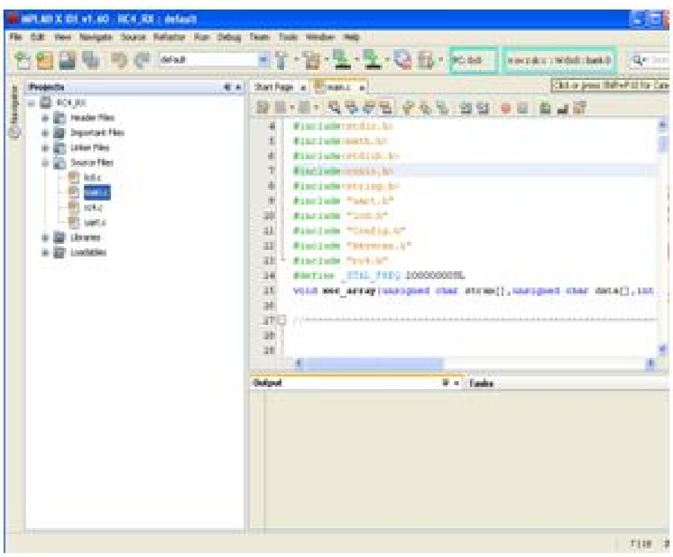

Figure 2: Programming Window

## V. RESULTS


Figure 3: Temperature Sensor Output On LCD.

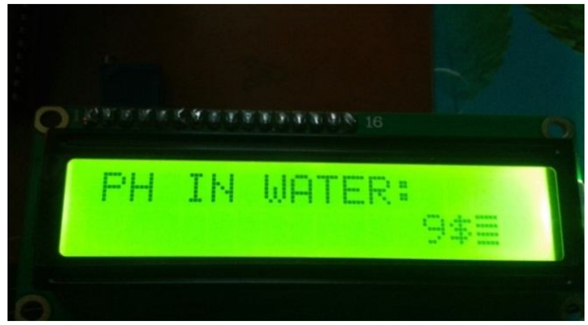


Figure 4: pH Values On LCD

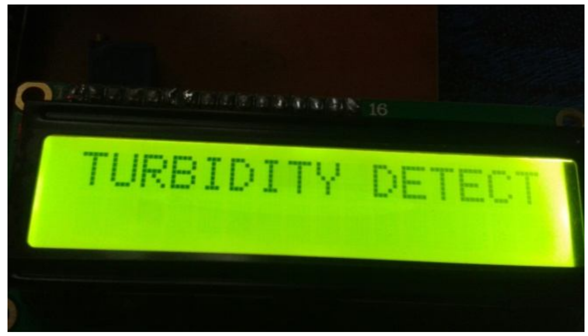


Figure 5: Turbidity On LCD

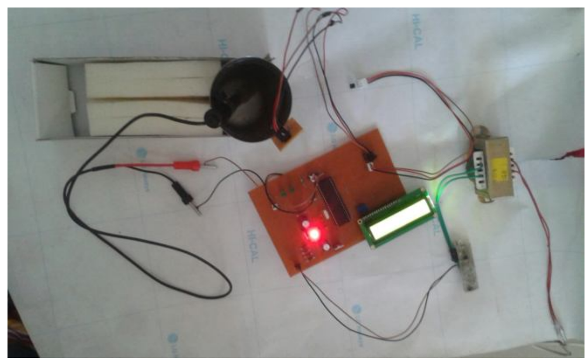

Figure 6: Developed System

## VI. ADVANTAGES

1) Low cost sensor nodes for real time and in pipe monitoring.
2) This inexpensive system is capable of detecting these high impact contaminants at fairly low concentration.
3) Low deployment operation cost and good detection accuracy.

## VII. CONCLUSION

The Project "Microcontroller Based Contamination Detection in Drinking Water" is based on different sensor which is based on temperature sensor, pH sensor and turbidity sensor by detect the content of water. The propose sensor node consist several in pipe water quality sensor with flat measuring probes. such implementation is suitable for large deployment enabling sensor network approaches for providing spatiotemporally reach data to water consumers, water companies and authorities.


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