

## Development of environmental wireless sensor with educational and preservationist purposes

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**Abstract.** *This paper presents the initial steps of the research in the context of an ongoing project entitled Water Quality. The activities are being developed at the IFRS Porto Alegre Campus - Brazil, in cooperation with CÉGEP de Sherebrooke - Canada, in which a multidisciplinary team is working to develop a Wireless Sensor Network (WSN) to be used in Computer Science and Environmental Management courses. The main goal is to monitor water quality via the Internet in some streams around the City of Porto Alegre to better understand the impact of society on this urban environment by measuring, recording, and transmitting information about water parameters at each stream monitoring site.*

### 1. Introduction

This work aims to develop a technological infrastructure that is able to carry out water quality monitoring, making the collected data available in real time over the Internet for educational and preservationist purposes. This structure will allow constant water quality monitoring and other possibilities such as tracking changes in the environment to analyze the evolution of this data, whose manipulation is crucial for learning situations in environmental courses. The advantage of using automated collection is that it makes it more convenient to create scenarios in the lab in which the professor can influence results in real time for learning purposes.

On one hand, students from environmental courses should be able to read, recognize, analyze, and interpret data collected from the environment, both manually and automatically. On the other hand, computer science students are challenged to design and develop a combined hardware/software system to meet a client's specifications (the environmental students, in this case). One possibility is to design the user interface to display water quality parameters both on PCs and mobile devices.

This work will give students the experience of acquiring and then using science and technology skills while at the same time providing a real-world application of science (environmental), technology (pre-engineering and computing), all connected to the theme of water quality with a multidisciplinary perspective. The project goals include a) the development of sensor network technologies in the computer science and engineering classes, b) the use of environmental sensors to teach technology,

engineering and science and c) encourage students to be aware of the local environmental situation, analyzing the data with a global perspective [Caine 1991].

Other researchers have designed wireless sensor networks to monitor water quality, such as [Ramanathan, Nithya; et al, 2006], [Regan, Fiona; et. al., 2009], [Zennaro, Marco; et al., 2009], [Rasin, Zulhani; Abdullah, Mohd Rizal., 2009] and [Dora, Mara A. et. al., 2011]. As a differential approach, our goal is to use all this technology in order to not only monitor and disclose water quality data to the general public, but also to use this information in the classroom as a challenge to our students in two main courses: environmental courses to develop new solutions for pollution and water quality; and computer courses to develop new hardware/software solutions to create a reliable WSN in hostile environments (e.g. environments with wireless communication near water, sensors in a polluted environment, instability in various weather conditions, communication delays, and so on).

The methodology of this work take a qualitative perspective via exploratory steps including steps such as readings to get data from WSNs, meetings and videoconferences with the team in order to elicit requirements and software development to test the transmission and processing of the collected data. These steps are included in the curriculum of the computer science, technological engineering, and environmental courses of the participating institutions.

### **1. The WSN brings new perspectives for the classroom**

A low-cost device (such as this WSN) that checks the trend of basic surface water variables (sampled at various locations) will monitor and provide support for the proposal of management plans for these environments. This kind of device will be used in practical classes of Environmental Science courses, in which students can simulate different environmental scenarios and propose technical solutions for the variables to remain in accordance with environmental standards.

### **2. Activities undertaken so far and expected results**

Considering that this work is being developed in the context of an international cooperation project between Brazil and Canada, the activities are supposed to be made in order to complement and fulfill the specific needs of each group. Brazilian and Canadian delegations composed by professors and students are in touch since 2011. The team has exchanged experiences in meetings, workshops and work in the labs in order to define activities and advance in the steps of the project.

The expected results include a) the creation of a set of wireless devices able to get environmental data in real time, manipulate it, and provide updated information automatically to allow the Internet to be used to access these data and also for learning purposes; b) the integration of knowledge from across the core curriculum — the remote sensor project required students to design an application that would work not only in the lab, but in a challenging real-world environment (i.e. in a stream). To succeed, students will need to apply skills and knowledge learned in their computing and environmental classes; and c) to work productively in a team environment—students will be required to collaborate with each other, with a client, and with international groups to define project specifications and to build parts in cooperation in order to solve environmental monitoring problems. In addition, indicators taken from

the Internet should be able to assess the effectiveness of local policies that may impact the environment. Finally, the studies and activities carried out in the project will serve as a practice to make students aware of the actual environmental situation, preparing them for a sustainable human society.

## References

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