SMART SYSTEM FOR MONITORING WATER QUALITY

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Abstract. *In this paper, it is analyzed one of the main problems of our time, which is water pollution. Also, we will describe the first phases of development of a system used to monitor the water quality at a local level (we will focus on our houses). Nowadays, many people try to monitor the quality of the water using different mechanisms and sensors. A huge number of devices are needed and the costs are really high, so it makes very difficult to have a wide range of this technology used. We come with a nice solution, which is a smart system for monitoring water quality, a simple system that will be available to each of us, cheap and easy to use. The system will be built using Internet of Things, which have the purpose of communication and exchange of information with other devices and systems over the Internet.*

Keywords*: IoT, sensors, Arduino, water pollution.*

1. Introduction

The main key of implementation of this project was use of IoT. Let us break down the concept of an IoT system and then present the introduction part to our problem. The Internet of Things (IoT) describes the network of physical objects— "things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools [1]. As a result, the use of IoT system brings a lot of benefits for people, decreasing or excluding the human work, as machines can do all the necessary stuff.

A problem that is dominating in our society last period is about water quality in our houses. Water represents a strategic product for human being, and its quality is essential for health and boosts the performance of our bodies. How to determine if the water is good, if the majority of lakes, rivers are polluted. Irrational human activity is responsible of such dramatic situation with the water quality. In this paper will be presented our idea about this problem, and a possible solution to it.

Here comes the use of the IoT, in which the cooperation between different systems could solve a huge number of problems. The proposed solution represents a "Smart system for monitoring water quality", a system that will be available to each of us.

2. System Architecture

As it was mentioned before, our project is based on monitoring the water quality in our houses. What components are needed to obtain such a system that will try to solve this problem? In order to answer the question, the general system architecture of the project is represented in Figure 1. From the block-diagram, we can present main components of the system, which are: sensors, Arduino UNO board, a power supply and a PC. Sensors detects changes in the water and transform them into measurable values that are transmitted to the Arduino board. In order to ensure distance communication, we will need a PC, and for the system to become functional, a power supplier is needed.

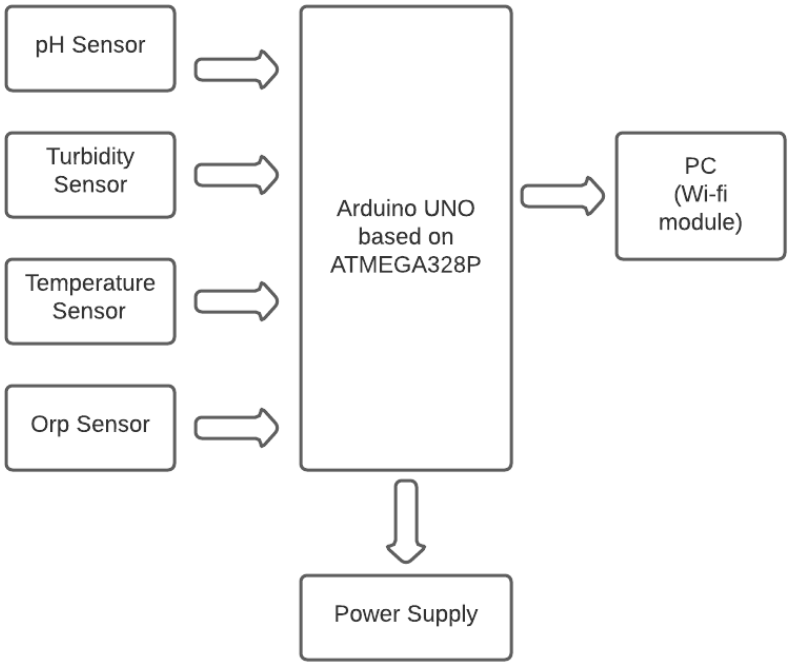

Figure 1. System architecture

pH sensor is an important parameter to be measured and controlled. The pH of a solution indicates how acidic or basic (alkaline) it is. pH sensor components are usually combined into one device called a combination pH electrode. The measuring electrode is frequently glass and quite fragile [2]. Use of pH sensor is very crucial, because either too basic or too acidic water cand damage to people's health, from weak immune system, to the inability to process key nutrients necessary for our body. Therefore, we decided to include this sensor and gave a priority to it.

Turbidity Sensor measure suspended solids in water, typically by measuring the amount of light transmitted through the water. Turbidity measurement is essential for quality assurance and process control in a wide variety of applications such as drinking water production, effluent monitoring, and sludge concentration measurement in wastewater treatment plants, monitoring of seawater inlets in desalination projects or product loss detection in dairies [3]. Thus, having this sensor helps us to improve the performance of the system and make it more precise in measuring the water quality.

An Oxidation Reduction Potential (ORP) Sensor measures the activity of oxidizers and reducers in an aqueous solution. It is a potentiometric measurement from a two-electrode system similar to a pH sensor. Sometimes it is also referred to as a redox measurement. Unlike a pH sensor, an ORP sensor measures the ratio of oxidized to reduced forms of all chemical species in solution [4]. This is a crucial sensor, because it can measure the quantity of chlorine that are in the water, when the maximum point is achieved and the water is not good for us.

Temperature Sensors measure the amount of heat energy or even coldness that is generated by an object or system, allowing us to "sense" or detect any physical change to that temperature producing either an analogue or digital output [5].

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button [6]. Arduino represents the core of the system, that is accessing all the values and then processing them to transfer through the Wi-Fi module and become available for the users.

3. Implementation

After the research and design phase it is time for implementation. We decided to make a desktop application for PC's, in which all the components are represented in a user-friendly manner.

Our application is designed to follow some well-defined requirements. One of the requirements for our application is usability. The app must be user-friendly and it should never distract the user from the main scope of the program. That means making the app as simple as possible while also providing many options for tech-savvy users.

The second and third requirements are availability and robustness. The program must be ready-to-use under a variety of circumstances and it should operate reliably.

The workflow of the application is straightforward. Changes that occur in water quality are immediately transmitted by the sensors to the Arduino board, which processes the data and over the Internet send them to the user.

Human interaction is reduced almost to 0, the only thing that user should do is periodically verify the data in order to ensure that the quality of the water that flows in his house system is safe and ready to use by human and different machines such as washing machines, kettles and so on.

4. Conclusion

As a consequence of this research, we have come to the conclusion that water quality in our houses are very important, not only for human's health but also for machines that we are using in order to facilitate our activities. Our solution is represented by a desktop application to monitor the water quality in the house.

Such a system will only bring benefits to people and their houses. It will be cheap and available for everyone. A user-friendly interface will attract the attention of people and we hope that this system will be functional in reality, with millions of users.

References

1. What is IoT [Access date 04.03.2021]. Available: https://www.oracle.com/internet-of-things/what-is-iot/
2. pH sensor [Access date 04.03.2021]. Available: http://www.uky.edu/WDST/PDFs/%5B21.2%5D%20Water%20Quality%20Sensors.pdf
3. Turbidity measurement [Access date 04.03.2021]. Available: https://www.endress.com/en/field-instruments-overview/liquid-analysis-product-overview/turbidity-sensors-transmitters#:~:text=Turbidity%20measurement%20is%20essential%20for,or%20product%20lo ss%20detection%20in
4. ORP sensor [Access date 04.03.2021]. Available: https://www.vernier.com/2018/06/18/why-you-want-an-orp-sensor/
5. Temperature sensor [Access date 04.03.2021]. Available: https://www.electronics-tutorials.ws/io/io_3.html
6. Arduino Uno [Access date 04.03.2021]. Available: https://store.arduino.cc/arduino-uno-rev3