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Simulation of Smart Water Quality Monitoring Device

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Abstract: ***Water contamination is one of the primary concerns for green globalization. Environmental monitoring is a fascinating system that has become increasingly important in 21st-century human life. To ensure a safe supply of drinking water and other water-related activities, water quality must be monitored in real time. This paper depicts a stage progression and plan for a small amount of effort. This research makes use of the Arduino Uno microcontroller, as well as a variety of sensors connected to the platform. The device, which is made up of a number of sensors, is used to determine the physical and chemical properties of water in various locations. Water quality factors such as pH, temperature, and Chlorine can be calculated. When estimated values were compared to W.H.O. standards, it was discovered that a cost-effective device for water quality management was required. In this paper we are trying to measure pH value for drinking water, temperature and chlorine content with the help of ORP sensor through simulation and then compared to standard value given by WHO. In this research paper our aim is to develop a system to evaluate the water quality based on simulation. Using a sensor we can collect data on various water quality parameters with minor variations. Following that, we can perform the necessary qualitative comparisons. It has also proven to be an effective tool for determining the impact of contaminated water. It is a effective tool for comparing data. Here we have used only three sensors pH , Temperature sensor and ORP sensor.***

Index Terms**: *IoT, Water Quality, Sensors, Cloud Computing, Machine Learning***

I. INTRODUCTION

In our daily lives, it is vital to keep an eye on the environment as well as our health. It is connected to humans since monitoring the quality of water and air around them will help to create awareness of the need to safeguard the environment. It is clear that environmental awareness is inadequate [1]. Global warming, limited water resources, and a growing population, among other reasons, are making water quality monitoring increasingly difficult. In order to improve water quality in a timely manner, modern procedures must be adopted. Water's beautiful characteristics pH is used to determine how familiar you are with hydrogen particles. It displays whether the water is basic or acidic.

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Water with a pH of 7 is pure; water with a pH of 8 is impure. On the pH_ scale, pure water has an equal quantity of Hydrogen and Hydroxyl ions, So water becomes neutral [2]. " pH" is a scale that measures acidity and alkalinity in a substance, with 0-6 acidic and 8-14 alkaline or basic being the most common values. The pH of pure water is 7. The majority of water isn't pure, and it can be acidic or basic [3].

A pool's water, for example, is slightly basic to function as a buffer against abrupt pH changes. People frequently add chlorine to water because it has a high ORP value [4]. When added to water, it raises the ORP value, which can harm bacteria's DNA and proteins. In this research work ORP sensor has been used in place of chloride sensor [5]. ORP sensor is oxidation reduction potential sensor. ORP is an ion exchange measurement [6]. Negative ORP substances can donate extra ions, whereas positive ORP substances absorb ions. All substances seek a state of stability by either shedding or grabbing electronics. People could drink water with varying levels of acidity and alkalinity if they couldn't calculate ORP and pH [7]. To function, the human body must have a negative ORP and be alkaline [8].

If a person has acidic blood, he would almost certainly die. The amount of energy in water expressed in terms of electrons is known as ORP. ORP is measured in millivolts because electron movement is electricity. The value of anti-oxidant water: Water with a negative ORP value has anti-oxidant properties. This relates to anti-aging and cellular health. ORP values that are positive, are oxidative and have the opposite effect. As previously stated, the majority of the water you drink, both tap and filtered, has oxidative properties [9]. If you can obtain drinking water with a negative ORP value, it can donate electrons to neutralize free radicals. Water with a positive ORP value, on the other hand, cannot. In the body, free radicals are unstable ions. They are produced by the body and can interfere with lipids, proteins, and DNA. In order for the body to function properly, free radicals must be balanced. Without it, the body can become overburdened and ill.

The standard of the water quality is a term used to describe the chemical, physical, and biological properties of water, generally in terms of suitability for a specific use. The process of sampling and analyzing water conditions and characteristics is referred to as water-quality monitoring. These characteristics are measured using a variety of water characteristics that have an effect on the designated uses of water bodies. Parameters are the characteristics of water that include dissolved oxygen, pH, nutrients, and temperature. Physical, chemical, and biological parameters are examples of parameters. In this research paper three water quality parameters have been measured.1.Temperature 2.pH 3.Chlorine content. Here three sensors have been used to measure above mentioned water quality parameters [10].

II. PROPOSED METHODOLOGY

The proposed research work is based on experimental demonstration. We are measuring three most important water quality parameters like pH, temperature and chlorine content in drinking water. Here pH sensor, temperature sensor and oxidation –reduction potential sensors have been used. Simulation has been done in Proteus software. As per standard parameters, pH value decreases as temperature increases. If the pH decreases as the temperature rises, this does not imply that the water becomes more acidic. If a solution has an excess of hydrogen ions over hydroxide ions (i.e., pH pOH), it is acidic. Even if the pH of pure water changes, the concentration of hydrogen ions and hydroxide ions remains constant, and the water remains neutral (pH = pOH). The issue is that we are all so used to 7 being the pH of pure water that anything else feels strange. The ORP scale typically ranges from -1000 mV to +1000 mV, and the sensors directly produce these values. While pH is a specific measure of the concentration of hydrogen ions in any solution, ORP only provides relative measure of chemicals present in the solution but unable to distinguish one from another. Although non-specific, it is a very useful and low-cost method of monitoring and controlling the activity of solution such as chlorine, ozone, bromine, cyanide, chromate, and other chemicals present in the solution for example water.

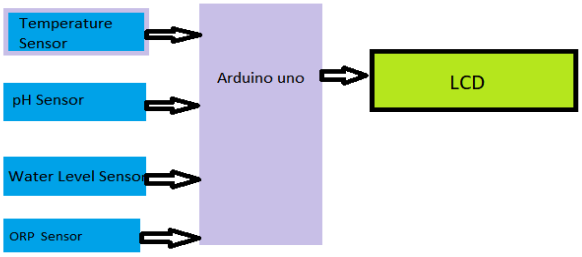

Fig: 1 Block diagram Water Quality Management.

Table1 represents water quality parameters as per WHO

TABLE I Water Quality Parameters Standard Value.

Parameter	Quality Range	Units
Ph	6.5-8.5	pH
ORP	650-800	mV
Temperature	20	℃

III. RESULT ANALYSIS

The circuit diagram is shown in fig:2.

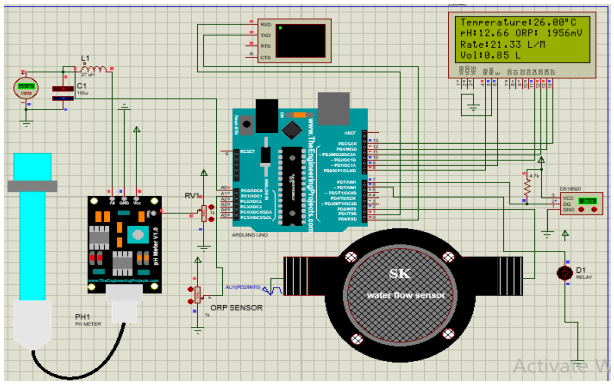

Fig:2 Smart Water Quality Measurement in Proteus software

Fig:2 represents simulation circuit in Proteus software. We have used pH sensor, water flow sensor and ORP sensor to measure quality of water. In the research work sensor node is considered and at this sensor node all the sensors are assembled to collect the data [9]. pH is very important for human body. As temperature increases pH value decreases but pH is also depends on kw (water constant) but in the simulation only temperature is considered. As per standard value of pH and Temperature , pH is decreases with increase in temperature. In simulation we found the same nature as per standard value. Fig:4

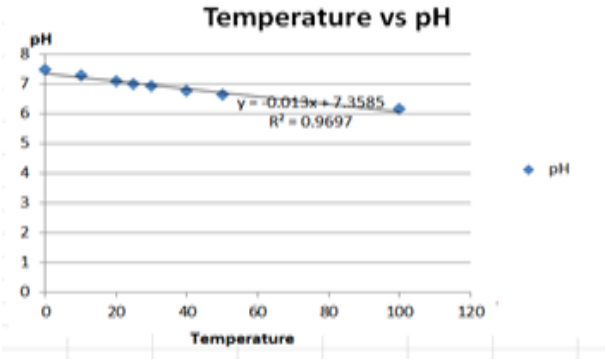

Fig: 4

Temperature vs pH as per WHO

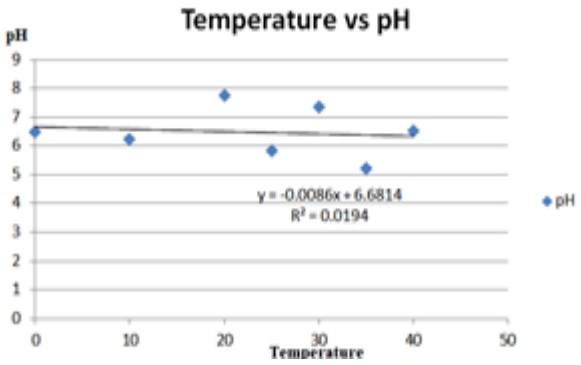

Fig :5 Temperature vs pH result from simulation

Figure 5 shows the pH vs temperature curve in simulation. Figure: 6 show ORP vs pH relationship. Contaminated water is very dangerous for all life and now this is the today's most important concern. Oxidation reduction potential is the sensor for determining water quality. A positive ORP value indicates the presence of an oxidizing agent and it is measured in mV.

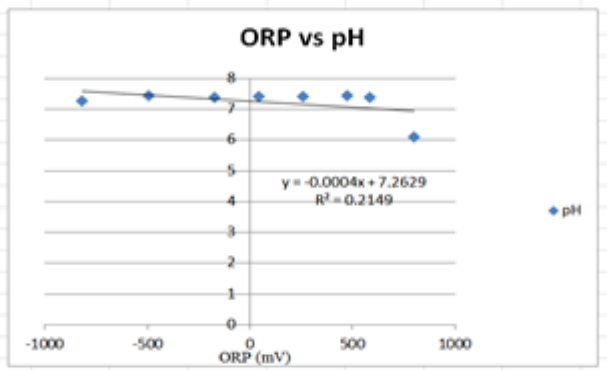

Fig : 6 ORP vs pH result from simulation

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Table-II

Temperature(℃)	pH	ORP(mV)
0	6.09	800
10	7.39	584
20	7.43	476
25	7.41	260
30	7.42	44
40	7.39	-170
50	7.49	-494
100	7.28	-818

A negative value indicates as reducing agent. High value of pH and negative value of ORP makes water good for use. Table-II shows the simulation readings of ORP sensor with respect to pH.

Table III

Type of Water	Range (mV)
Safe Drinking Water	+200 mV to 600 mV
Chlorinate pool water	+650mV to 750 mV
For phosphorus removal	+25mV to +250mV
Removal of Nitrogen	+100 mV to +350 mV
Biological phosphorus	-100 mV to -250 mV
Methane	-175 mV to -400 mV

IV. CONCLUSION

In this paper water quality parameters are discussed. The effects of above discussed parameters are explained .Standard values of pH and ORP values have been shown through simulation.

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Mrs. Nidhi Mishra has 15 years of Teaching Experience. She is Ph.D Scholar in Electrical Engineering at JJTU. She has done B.Tech in Electrical Engineering from Uttar Pradesh Technical University (U.P),India and M.E in Power Systems from P.V.G’s C.O.E.T , Pune ,India . Her research areas are Power Systems, Internet of Things, Machine Learning and Renewable Energy.

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