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Enhancement of Water Monitoring System

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Abstract *—This paper highlights design and development of a water monitoring system, with the objective of notifying the user of the real-time water quality parameters. The system is able to measure the physiochemical parameters of water quality, such as flow, temperature, pH, conductivity, and the oxidation reduction potential. These physiochemical parameters are used to detect water contaminants. The sensors, which are designed from first principles and implemented with signal conditioning circuits, are connected to a microcontroller-based measuring node, which processes and analyses the data. In this design, RF module receiver and transmitter modules are used for communication between the measuring and notification nodes. The notification node presents the reading of the sensors and outputs an audio alert when water quality parameters reach unsafe levels.* ***The qualitative and quantitative analysis of water samples of different localities was conducted to determine the exact amount of different pollutants present in water. The drinking water samples were taken from the main water sources where maximum peoples were using them for drinking purpose. The results indicated certain sources of water-borne diseases in drinking water, which are common in the people of a particular area. The results of the present research work showed that drinking water collected from different areas of Ab bottabad district was not found to be suitable for human health due to microbiological issues.***

Keywords-component; Water Monitoring System, AVR, PH Sensors.

I. INTRODUCTION

Water is essential resource of life for each living organism on the earth. Oxygen level in water plays important role in examining quality of water. Water quality plays important role in the health issues of human, plant and living organisms on the earth. Generally, main sources of water are rain, rivers and lakes. Rain water running over the lands contains many useful as well as harmful contents, may be soluble or insoluble. Acidity of water is decided by the salt and particles in soil. Traditional measure of water quality is transparency of water that means insoluble particles mixed in water degrades usefulness of water for particular application. The main aim is to measure the Ph, tds, Conductivity, Temperature and dissolved oxygen of drinking water as well as water that may be used for agriculture and industrial [1].

The remote access of water quality measurement parameters using wireless communication facilitates quality control, record keeping and analysis using simulation software at base station. Oxygen level, pH and TDS are the parameters that are analyzed and control to improve water quality process.

Following are the objectives of idea implementation. Measurement of Ph, tds, dissolved oxygen, Temperature of water using available sensors at remote place. To collect data from various sensor nodes and send it to base station by wireless channel. To control data communication between source and sink nodes. To simulate and analyze quality parameters for quality control. (Graphical and numerical record using MATLAB) .To publish the corresponding record over web for public information and further assessment of water resources [3].

II. WATER MONITORING SYSTEM

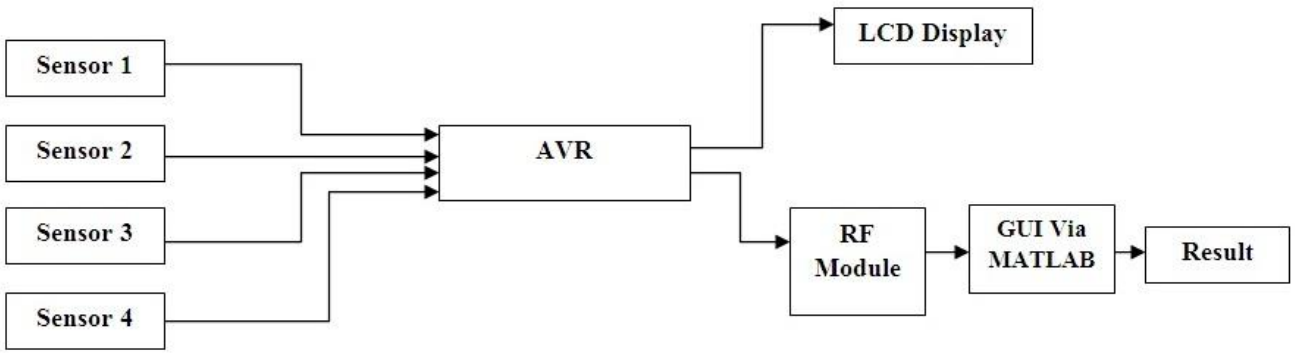


Fig. 1 Water Monitoring System

Water monitoring system is utilized to monitor parameters like PH value, temperature, dissolved oxygen; TOS is measured by the system. Then, data is send to bases station (controller) which processes and analyzes the data & display on LCD. Data collected by base station such as PH, TDS etc. is sent to the remote monitoring station. That collected data at the remote site can be displayed in virtual format on a server pc with the help of MATLAB using GUI.

2.1. Major Components of Water Monitoring System

A. ***Ph sensor:*** A ph Meter is a scientific instrument that measures the hydrogen-ion concentration (or pH) in a solution, indicating its acidity or alkalinity. The pH meter measures the difference in electrical potential between a pH electrode and a reference electrode. It usually has a glass electrode plus a calomel reference electrode, or a combination electrode. In addition to measuring the pH of liquids, a special probe is sometimes used to measure the pH of semi-solid substances. For very precise work the pH meter should be calibrated before each measurement. For normal use calibration should be performed at the beginning of each day. The reason for this is that the glass electrode does not give a reproducible e.m.f. over longer periods of Time. [7]

B. **Resistance thermometers**: It also called **resistance temperature detectors** (**RTDs**), are sensors used to measure temperature. Many RTD elements consist of a length of fine wire wrapped around a ceramic or glass core but other constructions are also used. The RTD wire is a pure material, typically platinum, nickel, or copper. The material has an accurate resistance/temperature relationship which is used to provide an indication of temperature. As RTD elements are fragile, they are often housed in protective probes.RTDs, which have higher accuracy and repeatability, are slowly replacing thermocouples in industrial applications below 600 °C [1].

2.2. Water Quality Parameters:

A. ***PH Value:*** PH is a measure of a solution's acidity. In water, small numbers of water molecules (H2O) will break apart or disassociate into hydrogen ions (H+) and hydroxide ions (OH-). Other compounds entering the water may react with these, leaving an imbalance in the numbers of hydrogen and hydroxide ions. When more hydrogen ions react, more hydroxide ions are left in solution and the water is basic; when more hydroxide ions react, more hydrogen ions are left and the water is acidic. pH is a measure of the number of hydrogen ions and thus a measure of acidity.

B. ***Turbidity:*** Turbidity is a measure of how particles suspended in water affect water clarity. It is an important indicator of suspended sediment and erosion levels. Typically it will increase sharply during and after a rainfall, which causes sediment to be carried into the creek. Elevated turbidity will also raise water temperature, lower dissolved oxygen, prevent light from reaching aquatic plants which reduces their ability to photosynthesize, and harm fish gills and eggs.

C. ***Dissolved Oxygen:*** Dissolved oxygen is oxygen gas molecules (O2) present in the water. Plants and animals cannot directly use the oxygen that is part of the water molecule (H2O), instead depending on dissolved oxygen for respiration. Oxygen enters streams from the surrounding air and as a product of photosynthesis from aquatic plants. Consistently high levels of dissolved oxygen are best for a healthy ecosystem. Levels of dissolved oxygen vary depending on factors including water temperature, time of day, season, depth, altitude, and rate of flow. Water at higher temperatures and altitudes will have less dissolved oxygen. Dissolved oxygen processes such as respiration, oxidation, and respiration continue, until shortly before dawn. Human factors that affect dissolved oxygen in streams include addition of oxygen consuming organic wastes such as sewage, addition of nutrient nutrients, changing the flow of water, raising the water temperature, and the addition of chemicals.

2.3. Chemical Parameters:

A. ***Nitrate:*** Nitrogen is abundant on earth, making up about 80% of our air as N2 gas. Most plants cannot use it in this form. However, blue-green algae and legumes have the ability to convert N2 gas into nitrate (NO3-), which can be used by plants. Plants use nitrate to build protein, and animals that eat plants also use organic nitrogen to build protein. When plants and animals die or excrete waste, this nitrogen is released into the environment as NH4+ (ammonium).

B. ***Phosphate:*** Phosphorus in small quantities is essential for plant growth and metabolic reactions in animals and plants. It is the nutrient in shortest supply in most fresh waters, with even small amounts causing significant plant growth and having a large effect on the aquatic ecosystem. Phosphate-induced algal blooms may initially increase dissolved oxygen via photosynthesis, but after these blooms die more oxygen is consumed by bacteria aiding their decomposition. This may cause a change in the types of plants which live in an ecosystem.

C. ***Base Flow vs. Storm Flow*****:** Data is reported as being in a storm flow condition when a judgment is made by the data gatherer that the volume of water in the stream has significantly increased beyond a base flow condition, usually because of recent precipitation.

III. GUI USING MATLAB

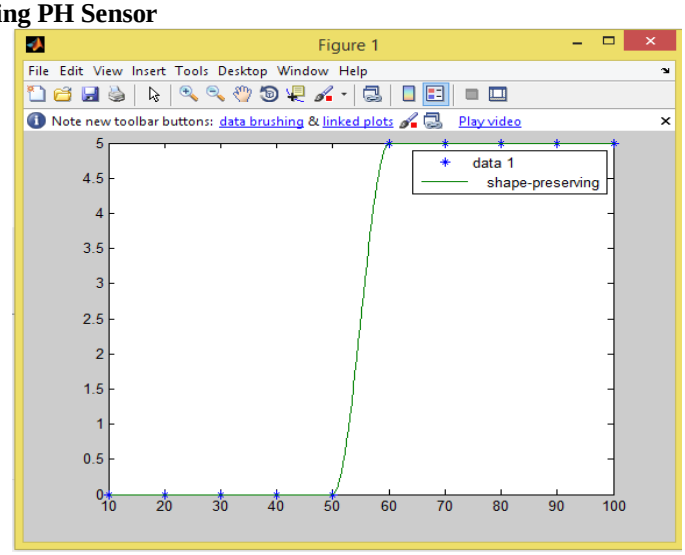
MATLAB is a programming language developed by Math Works. It started out as a matrix programming language where linear algebra programming was simple. It can be run both under interactive sessions and as a batch job.

3.1. G.U.I

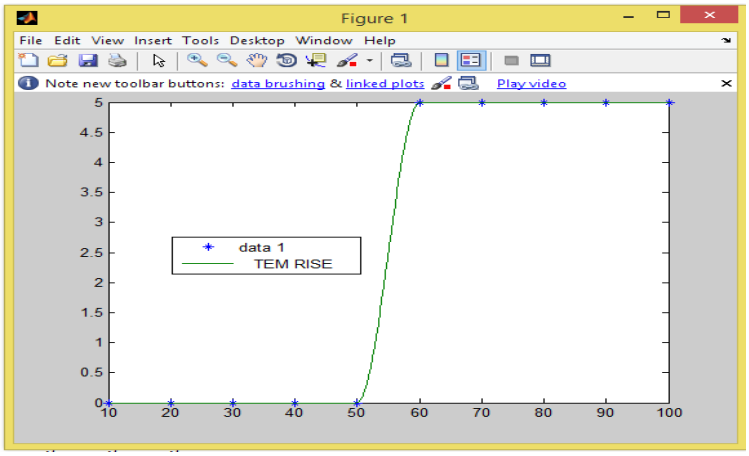
The main reason GUIs are used is because it makes things simple for the end-users of the pram. If GUIs were not used, people would have to work from the command line interface, which can be extremely difficult and frustrating. Imagine if you had to input text commands to operate your web browser (yes, your web browser is a GUI too!).It wouldn't be very practical would it? In this tutorial, we will create a simple GUI that will add together two numbers, displaying the answer in a designated text field.

RELAY SWITCHING IN TRIGGERING IN MICROCONTROLLER

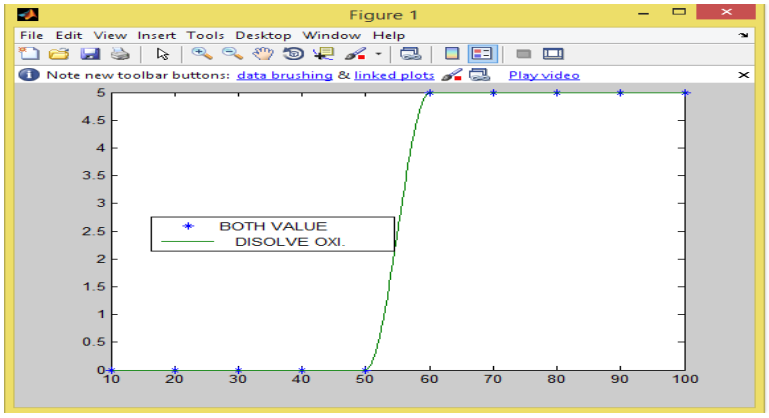
- **Automatic Switching PH Sensor**



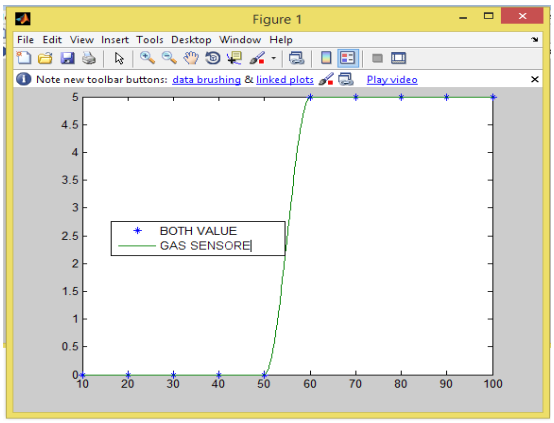
- **Temperature Sensor**



- **Dissolved Oxygen Monitoring**

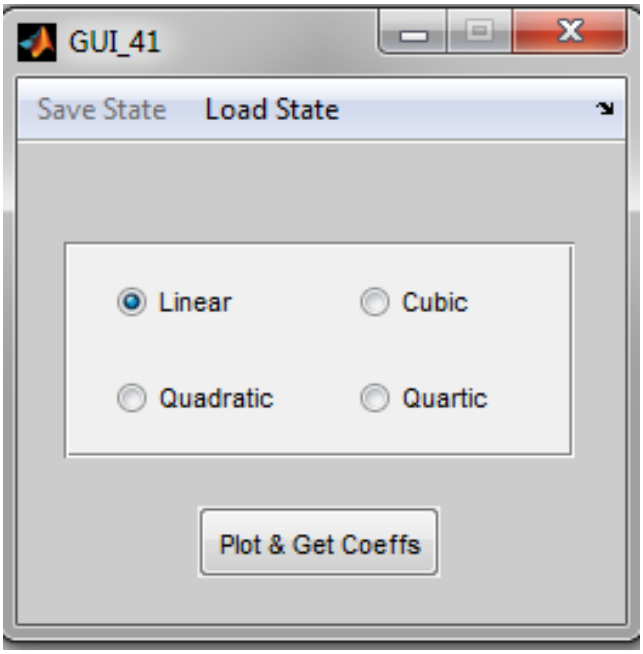


- **Gas Monitoring**



- **G.U.I. Representation :**

Step 1:



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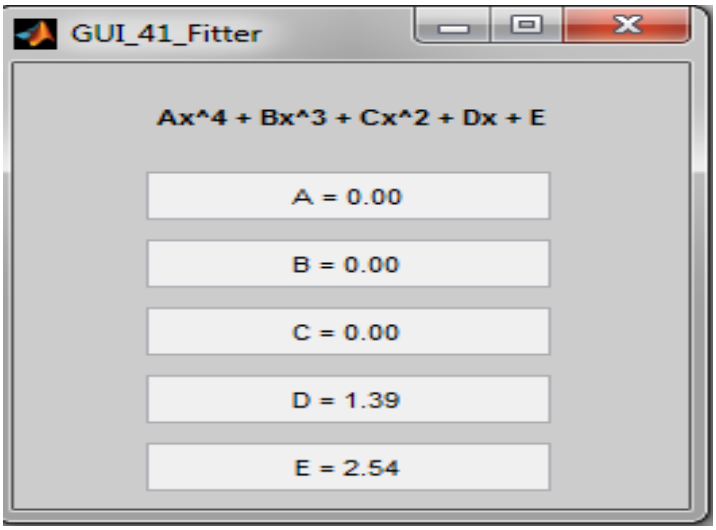
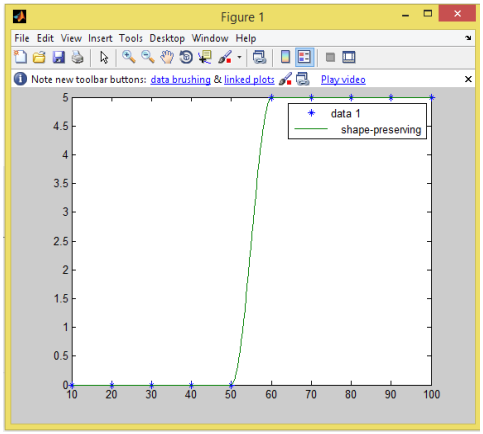


Step 3:



IV. CONCLUSION

This monitoring system consists of three parts: data monitoring nodes, data base station and remote monitoring center. It presents us with useful features such as large monitoring ranges, flexible configuration, low power consumption, small damage to the natural environment and low cost. This paper is devoted to the explanation and illustration for our new design of water environment monitoring system, based on a wireless sensor network. The system generally includes three parts: hardware and software of data monitoring nodes, hardware and software of the data base station, as well as software for the remote monitoring centre. The system successfully performed an on line auto monitoring of the water temperature and pH environment of an artificial lake. Access to clean drinking water and adequate sanitation is a priority at times like this. The threat of disease increases hugely due to the large numbers of people living close together, often in squalid conditions, and without proper sanitation. After a natural disaster, as far as water quality testing is concerned there are widespread views on the best course of action to take and a variety of methods can be employed. The key basic water quality parameters that need to be addressed in an emergency are bacteriological indicators of fecal contamination, free chlorine residual, pH, turbidity and possibly conductivity/total dissolved solids. There are a number of portable water test kits on the market widely used by aid and relief agencies for carrying out such testing [8].

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