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Real Time Water Quality Monitoring and Control System

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Abstract: Water quality monitoring is a method used to check the water parameters to indentify the trends of change, pollution levels and thus helps to decide and implement the pollution control systems. Water quality monitoring and control of swimming pools, ponds and other manmade water bodies are important to safeguard public health and is thus in the general interest of the environment and society. Conventional methods involve time consuming and laborious methods of sample collection, testing and data recording. This paper mainly focuses on the development of a system which comprise of online connectivity for collection of data from water body for monitoring and control. Programmable Logic Controller PLC is used to make the system automatic along with Arduino and Bluetooth module to collect data on mobile phone. Several sensors are used to measure water parameters for checking overall water balance. The prototype checks and tests alkalinity of water, Ph level , water temperature etc. Drinking water treatment could be the future scope of this project. Also the waste water treatment could be an application of this project.

Keywords: Water quality monitoring, Programmable Logic Controller, Arduino, Bluetooth

I. INTRODUCTION

With the ever increasing demand on water resources, the need for effective and efficient water quality monitoring and control systems is becoming a great necessity to the society improving the water quality standard and also in safeguarding the public health. A good water balance is the goal of operation. The main water pollutant in pools is due to bathing and ablution. The human beings pollute the water of pools through their presence which deposits human waste in the water like hairs, sweat, urine etc. These result in the birth and outbreak of microbes in the water bodies. This also results to disease outbreak in the pools including E.coli. To control such disease outbreak continuous disinfection of pool water is required. Thus automatic water quality monitoring is very necessary.

Table 1.1: list of pool water parameter

S.no.	Factors affecting	Method to increase level	Method to decrease level
1.	Temperature	Turn Heater on	Turn Heater off
2.	Ph level	Add NaHCO ₃	Add Hcl
3.	ORP	Add Ca(OCL) ₂	n/a

II. RELATED KNOWLEDGE

Today many different forms are being used in the pool cleaning process like Calcium hypochlorite, etc. There are various factors which effect the functioning of the disinfectants. The amount of chemical used, the concentration used, nature of water body, temperature of water, water alkalinity etc. [1] The capability of chemicals and disinfectants to kill and destroy microbes and contribute to water cleaning process are affected by these factors. The oxidation reduction potential which is called as the redox potential of water body is generally measured by ORP probe. The effectiveness of the disinfectant is indicated by the redox potential. The redox readings are independent of the chlorine concentration of the water body. The redox readings indicate poor or good disinfection of water.

Other factors like water hardness and dissolved solids also affect the water bodies disinfection process.

The various values of CaCO₃ define different levels of hardness levels and corrosivity values of the water and other materials present in the pool or water body. The table below gives various water parameters. Paul Duffy Gerry woods James Walsh Michale Kane [8] suggested Monitoring and control of swimming pool through LABVIEW and Compact Rio embedded controller and measured various parameters.

Irina-Elena & Dănuț-Ionel [12] gives very simplified method of data acquisition of water parameter through personal computer which measures and stores the data effectively. This framework is of fixed type. Mingfei Zhang, Daoliang Li Lianzhi Wang,

Daokun Ma & Qisheng Ding [13] used Wireless sensor network to collect data and system characteristics. This framework proved to be smart and intelligent network which works efficiently. Jayti bhat & Jignesh Patoliya [11] used IOT method for monitoring Water quality parameters. Raspberry pi controller is used with zigbee protocol. Sensors data can be view on internet browser.

III. PROPOSED METHODOLOGY

In order to continuously monitoring the water, different sensors will be used to measure the parameters which are listed below in table. Controlling of parameters will be done through PLC which control the dosage pump and heater and maintain the parameters at their ideal values. PLC programming will be done through Rs logix 500 software. When the parameters will be above or below their specific values a message will be sent to Smartphone through Bluetooth module. Thus, smartphone will act as a display device .

Table 1.2: Sensing Method

S.no.	Parameter	Sensing Method
1.	Temperature	DS18B20 waterproof sensor
2.	Ph	Ph probe with bnc connector
3.	Oxidation Reduction Potential	Chlorine probe with bnc connector

IV. SYSTEM OVERVIEW

The basic system of water monitoring and control is shown in the block diagram below. Programmable Logic Controller is the main system component. Other than PLC , Arduino and Bluetooth Module is used to allow real time monitoring
 A PLC, Programmable Logic Controller, is a digital computer used for automation of basically the industrial processes such as amusement rides or assembly lines. They have many digital and analog input-output ports and are able to be worked upon in extended temperature ranges. They have good immunity to noise and resistance to vibration and impact. Programs can be uploaded from or downloaded onto a PLC through Ethernet, RS-232, RS-485, or RS-422 cables from a computer. Sometimes the programs are also transferred through a removable chip such as an EPROM. The PLC used in this paper has been programmed using ladder logic which is a logical representation of NOs (normally open) switches and NCs (normally closed) switches.



Fig 3: Bluetooth Module

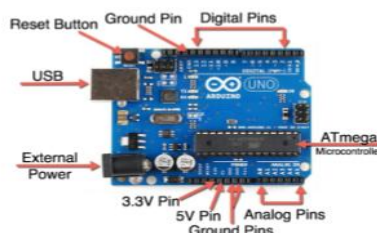
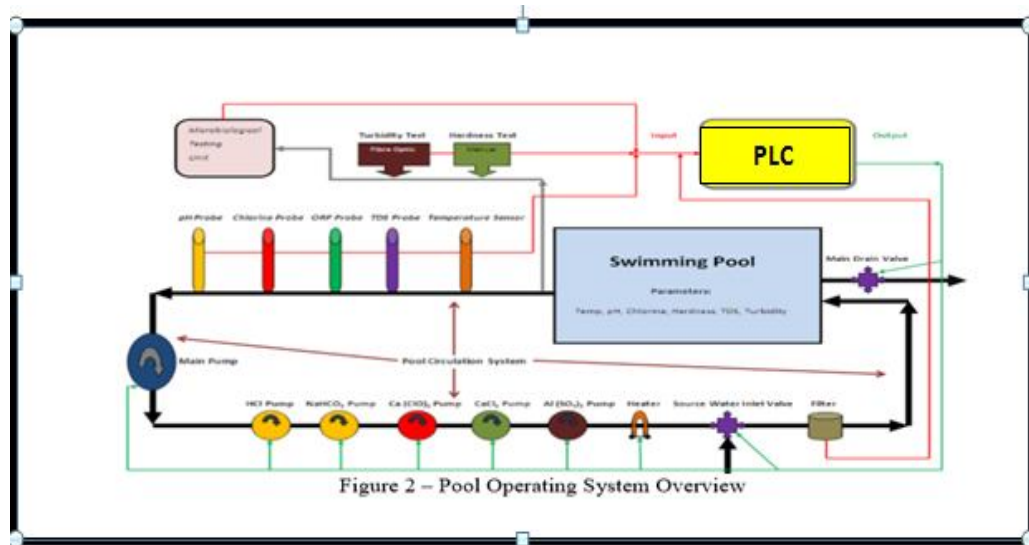


Fig. 2. Arduino Uno

An ARDUINO UNO is a single board microcontroller based on the Atmega328. It is open source hardware- software used for development of electronic devices and its interfacing. Arduino uses SRAM memory with flash and EEPROM storage technology. It is a 14 pin device operating at 5volts supply.

A BLUETOOTH MODULE, A HC-06 wireless Bluetooth transceiver RF main module serial for Arduino is used to transmit and receive serial data wirelessly over the phone. This module is used for establishing wireless Bluetooth connection between two devices.



V. CONCLUSION AND FUTURE WORK

The prototype developed for water quality maintenance is very beneficial for safeguarding public health and also adds to the clean environment. The automation of this water monitoring, cleaning and control process removes the need of manual labor and thus saves time and money. The automation of the system makes the control and monitoring process more efficient and effective. Real time monitoring on mobile phone which is possible through the interface of plc with Arduino and Bluetooth module allows remote controlling of the system.

The future scope of this project is monitoring environmental conditions, drinking water quality, treatment and disinfection of waste water etc. This system could also be implemented in various industrial processes. The system can be modified according to the needs of the user and can be implemented along with lab view to monitor data on computers.

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