

IOT based Real Time Water Grade Tracking System using Solar Energy

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Abstract—Water quality is an important issue in everyday life. Municipalities and big organizations install Water purifier system and monitoring at their level. But when it comes to the society or school level, such a huge and expensive water quality system and purifier cannot be used. So we have designed economical and robust system that can check water grade and update organization on water condition. Water quality measurement using GPRS and web based monitoring and is proposed to control water pollution and human diagnosis due to the water pollution. Solar panel is used to save the electricity. The different sensors are used to measure the different parameters of the water. The standard values of the parameters stored in database are compared with the measured values. If measured values are not approximately equal to standard values then, the quality of water does not meet the requirement.

Keywords— IOT, Sensors, Automation, Real-time system, ARM7TDMI

I. INTRODUCTION

Currently drinking water faces many challenges in the current situation due to growing population and pollutants from industries, agriculture waste etc., are mixed with drinking water. Traditional methods of testing drinking water quality parameters like, turbidity, pH, conductivity and temperature etc., may consume time because samples are tested manually in the laboratory. To overcome this, in our paper we are proposing smart and low cost system for real time monitoring of water quality by using ARM 7, which provides global testing. The parameters considered to test quality are Temperature, Turbidity, pH, Conductivity. Sensors immersed into sampled water measure the parameters. The sensed data is sent to the ARM7 LPC2148. Through GPRS Module data is sent to web server. The sensed data parameters are compared with the standard values which already exist in ARM7 LPC2148. The data stored in ARM7LPC2148 is accessed from the Web server. If there is any discrimination then we get a mail through INTERNET.

II. OBJECTIVES

1. Measurement of pH, Conductivity, Temperature and Turbidity of water using available sensors at remote place.
2. To display the measured values of parameters on LCD.

3. To display the measured values of parameters on web site for public information.

III. METHODOLOGY

We are using GPRS Module (SIM 800L) for communication. GPRS is mobile data service on 2G and 3G communication system which is packet oriented for Mobile Communications. European Telecommunications Standards Institute (ETSI) standardized GPRS originally. GPRS undertakes packet-data switching, which does not guarantee certain standard output as in circuit switching. The throughput and latency vary in this type of switching depending upon number of users sharing the service concurrently. Data rate provided in GPRS is 56 kb/s - 114 kb/s. 2G systems combines with GPRS to make 2.5G i.e. intermediate technology between 2G and 3G generations of Mobile Communication. GPRS provides following services.

- a. SMS messaging and broadcasting
- b."Always on" internet access
- c. Multimedia messaging service (MMS)
- d. Push-to-talk over cellular (PoC)
- e. Instant messaging and presence—wireless village
- f. Internet applications for smart devices using wireless application protocol (WAP)
- g. Point-to-point (P2P) service: inter-networking system

IV. BLOCK DIAGRAM AND WORKING

This circuit is divided into two parts one is controller module with sensors and second is wireless communication of the data. We have used LPC 2148 Controller Development board which is in the family of ARM 7 controllers. ARM7 development board on chip contains DAC, LCD and so many features. Controller is a central device of our project. 4 Sensors are connected to the different ports of the controller.

We have used 4 sensors for monitoring of water quality. Temperature sensor, Turbidity sensor, Ph sensor and conductivity sensor individually check the water parameters as per their specifications. First for working of sensors, they are submerged in the water storage. Then they check the parameters like temperature, turbidity, Ph value and conductivity of water. They create analog signal or information.

This information supposed to be converted into digital. LPC 2148 development board have on chip 10 bit ADC for conversion. When all the data is converted into digital, we get parameter display on LCD.

For wireless communication we have used GPRS module (SIM 800L). This GPRS module is installed on MAX 232 board. MAX-232 IC consists of 16-pins which is used in voltage level signal problems. GPRS that is General Packet Radio Service makes use of packet switched data. It does not require any end to end connection. Generally MAX 232 needs to be connected to controller by RS-232. Recommended Standard 232 (RS-232) is serial communication standard introduced in 1960 for transmission of data. It defines a connection between a DCE(Data Communication Equipment) like a modem and DTE(Data Terminal Equipment) like a computer terminal. It is commonly used standard for computer serial ports.

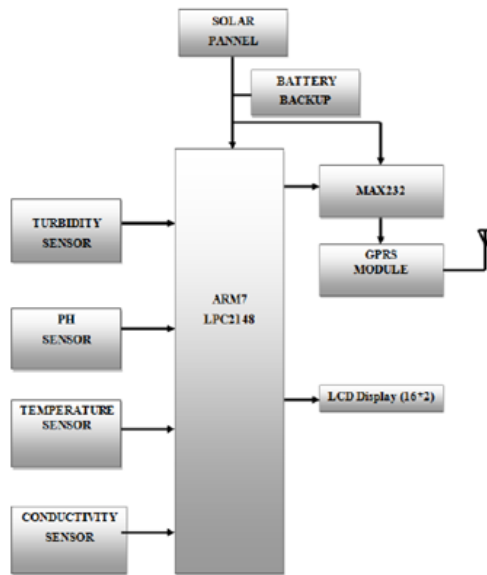


Fig. 1. Block Diagram for System

It defines electrical characteristics and timing of signals and physical size and pin out structure of connectors. For serial technology, RS-232 is a physical layer standard. RS-232 converts controller signal or information in appropriate form and gives to GPRS module. GPRS module sends information using 2G or 3G data sends it to web page or server. WWW (World Wide Web) and web browsers use a document called web page. A web page is displayed on screen by the web browser. A web page refers to a computer file written usually in markup language such as HTML (Hyper-text Markup Language). Web Browsers are great utility which coordinate all the style sheets, images, scripts to present the web page. We designed the web page to publish water quality parameters value on internet. People who are in monitoring station continuously monitor the data and take appropriate decision. This web page is designed using PHP and Java SQL. We have also given threshold value to Temperature and if temperature of water at any time increases above threshold value then Email alert will be given to the respective user. All the 4 sensors are used as Real time purpose that is when power supply is given they continue to check parameters. On the web page along with parameter values date and time of observation is also recorded. Hence by using this system we can effectively measure the water quality parameters and take appropriate decision if desired value is not observed.

V. HARDWARE USED

A. Microcontroller LPC 2148

LPC2148 is a development platform based on LPC2148 ARM7TDMI microcontroller which is powerful and with 512K on-chip memory. This board does not need external power supply, it is powered by USB port [7]. For applications involving high speed wireless communication (WiFi / Bluetooth / Zigbee), real time data monitoring, USB based data logging and interactive control panels, this development board is ideal [8]. With direct high speed interface to a PC/laptop with on-chip USB controller provides speeds up to 12Mb/s. The UART boot loader allows you to program using serial port and eliminates need of an additional programmer. SD/MMC card interface, USB2.0 interface, Xbee / Bluetooth / WiFi wireless module interface, 4Kbit 12C EEPROM, L293d DC motor controller are some of the on board peripherals.

B. MAX 232 Board and GPRS Module SIM 800L

The signals from RS232 serial port are converted to proper TTL signals which are digital logic circuits by this integrated circuit. It can convert signals like CTS, RTS, TX and RX and it is also a dual driver/receiver. The driver increases the output voltage levels of TIA232 from a 5 volt supply to 7.5 volts by using the external capacitor and on chip charge pumps. The receiver reduces the input levels from 25 volts to the standard voltage level, i.e. 5volts of TTL levels and there is a threshold of 1.3 volts and hysteresis of 0.5 volts for the receiver. Further the max232 IC is extended with receivers and transmitters to give MAX238 and MAX248 and there are many combinations of such receivers and transmitters. A SMT type solution Quad-band GPRS/GSM is SIM800 which can embedded in consumer applications. It supports 850/900/1800/1900 MHz Quad-band on which it can transmit data information, SMS and Voice with negligible power consumption. Due to its tiny size(24*24*3mm), it can provide to compact demands of customer and fit into slim slots. It allows total cost savings and fast time-to-market for customer applications featuring Bluetooth and Zigbee.

C. Sensors

1) *Turbidity Sensor TSD-10*: The turbidity in wash water and washing machines is measured by TSD-10 module. Using the refraction of wavelength between photo transistor and diode, the optical sensor measures turbid water density or extraneous matter concentration for washing machine. An optical washing machine sensor measures the amount of light coming from source to destination in order to calculate turbidity of water using optical diodes and transistors. The amount of light passing through the sample is inversely proportional to amount of soil in water is the principle on which the sensor operates. Amount of light decreases as the amount of soil in water increases. To determine the turbidity of wash water, the turbidity sensor measures the amount of light transmitted through the sample.

2) *Temperature Sensor LM-35*: LM35 series are temperature sensors integrated circuit which gives output voltage linear to the Celsius (Centigrade) temperature. It has an advantage over temperature sensors calibrated in Kelvin, as manual subtraction of a constant from its output is not required. The application of LM35 can be done in same way as other integrated circuit temperature sensors. It can be fixed or glued to a surface and temperature will be within range of about 0.01 degree of surface temperature.

3) *pH Sensor*: pH is important parameter which indicates if the solution is acidic or basic. It has to be measured and controlled efficiently. The combination of pH sensor components in one device is called combination pH electrode. Electrode is mostly made from fragile material like glass. Developments have been made to replace glass with more durable solid-state sensors. The analyzer has a man-machine interface for calibrating the sensor and configuring alarms and output, if pH control is being done.

4) *Conductivity Sensor*: A versatile tool in process control is conductivity measurement. A little maintenance is required if measurements to be measured are most advanced, simple and fast. Various assumptions on what is happening in the process can be made based on measured conductivity reading. Concentration of the liquid can be calculated in some cases by developing a model. Concentration of the liquid can be measured along with conductivity and temperature. The curves for various acids and bases that are preset are commercially available.

VI. APPLICATIONS

A. Residential Society

We know that nowadays corporations and government set their Water quality monitoring and treatment plants on water tanks. But when it comes to Residential society, it is very rare that we see monitoring system in societies. So our design is very affordable and scalable to place system in societies.

B. Hospitals

In the Hospitals and Medical clinics it is very important to serve quality and pure water to patients and visiting people. In our design we define some parameters to check water quality like turbidity, PH it is necessary to maintain turbidity level and Ph level of water.

C. Chemical Laboratories

In the chemical laboratories or pharmaceutical laboratories it is necessary to maintain temperature and ph value in moderate level. Hence temperature sensor will help to monitor the water temperature.

D. Agricultural Purposes

When the water level reaches the adequate level, water level sensor will send the information to the microcontroller and makes the water pump motor OFF [9]. The farmer can request information through GSM and get it whenever applied.

VII. RESULT AND CONCLUSION

Water quality is a one of the most basic and necessary need of people. Hence water quality monitoring and filtering is need of society. This project will ensure the monitoring of water quality in basic manner that is water for application and industrial purpose. Quality of water is monitored and sequential follow up of water pollution in remote areas is achieved. This system not only provides comprehensive evaluation of water environment but also can quickly measure the water quality parameters as a real time process. Researching and developing a working prototype enhance self-confidence and assure that it is possible to design a system and apply it for solving particular problem by acquiring necessary information. Moreover designing and developing the prototype of wireless communication for remote access of information is needful and helpful in remote areas.

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