Smart Water Quality Management System

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Abstract

Water is a limited resource used in our day to day life for agricultural, recreational, domestic and for a healthy living. So it has become a necessity for adequate and integrated water management such as water level and quality monitoring and to check its efficient usage. Wireless Sensor Network technology helps to monitor the quality of water with the help of sensors immersed in water so as to keep the water resource within the standard that is described for domestic usage and allow to take necessary actions to restore the health of the degraded water. IOT has been used for sensing the parameters and to connect with the GSM. The sensor nodes consist of PIC microcontroller, GSM and water quality sensors to measure the parameters such as pH, water level and gases. Data collected from different nodes will be displayed in the PC. The data collected from the sensors are being sent to the cloud center using GSM modem which is enabled using SIM card. These data values can be viewed in the website or the android application on a recurring basis. The motor can be controlled from the website or the android application that has been created. The asset of the developed system is that it's compact, optimal usage of power and can be installed easily.
Keyword- GSM- Global System for Mobile, PIC- Peripheral Interface Controller, SIM- Subscriber Identity Module, pH- Potential of Hydrogen, IOT- Internet of Things

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I. INTRODUCTION

Water resources need to be monitored because of contamination or release of chemicals by individuals and manufacturing industries. Water monitoring system is essential to ensure the quality of drinking water and to keep the water pure and sustainable. There is a need for continuous remote monitoring of water quality parameters within the water system as the concentrations of the pollutants lead to serious health consequences.

Traditional approaches include sending water samples to laboratories and its analysis which is quite time consuming and expensive and moreover water cannot be monitored in a timely manner. This project aims to develop water monitoring system that monitors the quality of water remotely across wireless network zones. Wireless network nodes have significant advantages in terms of communication, reduced maintenance expenses and installation time.

Wireless network for water monitoring system consists of various sensors such as pH sensor, gas sensor, water level sensor which can be immersed in tanks in a specific area. There is a PIC microcontroller and an IOT module and water quality parameters are read. These values are then sent to a cloud server where it is logged for future reference. GUI is provided to the users through android applications or website where the user can analyze the recorded data when water quality is detected below standards. These actions are again evaluated to ensure feasibility and effectiveness of the proposed water monitoring system.

II. SYSTEM ARCHITECTURE

The system consists of sensor nodes where the sensor data is send to the cloud server through a unique network. The wireless sensor nodes are immersed in overhead tanks where the water is monitored continuously. The cloud database is connected to the internet where the user can login and monitor the data. With the help of these information's from the sensor we can keep the water resources within a standard described for domestic usage and to maintain water quality. The system architecture is shown in fig 1

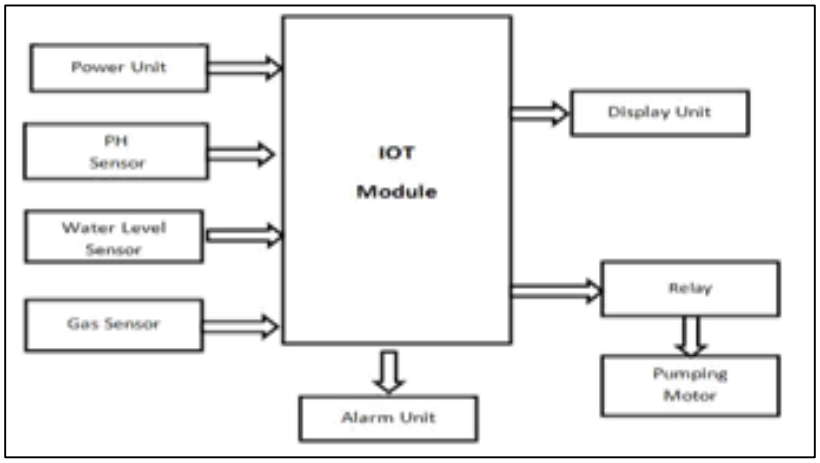


Fig. 1: System Architecture

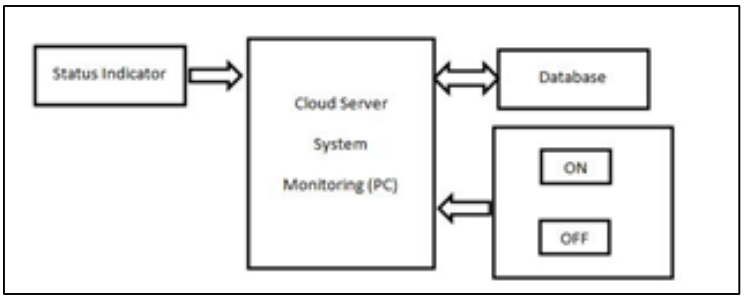


Fig. 2: Cloud Section

III. DESIGN OF WIRELESS NETWORK SENSOR

The sensor node consists of sensor module, power module, communication module. The sensor module consists of pH sensor, water level sensor and gas sensor which checks for the appropriate standards of water. The processing module transfers the recorded paramters.PIC microcontroller is used to process the data as it is low cost, low power, more compatible and the large amount of I/O pins provide us to connect more number of sensor.

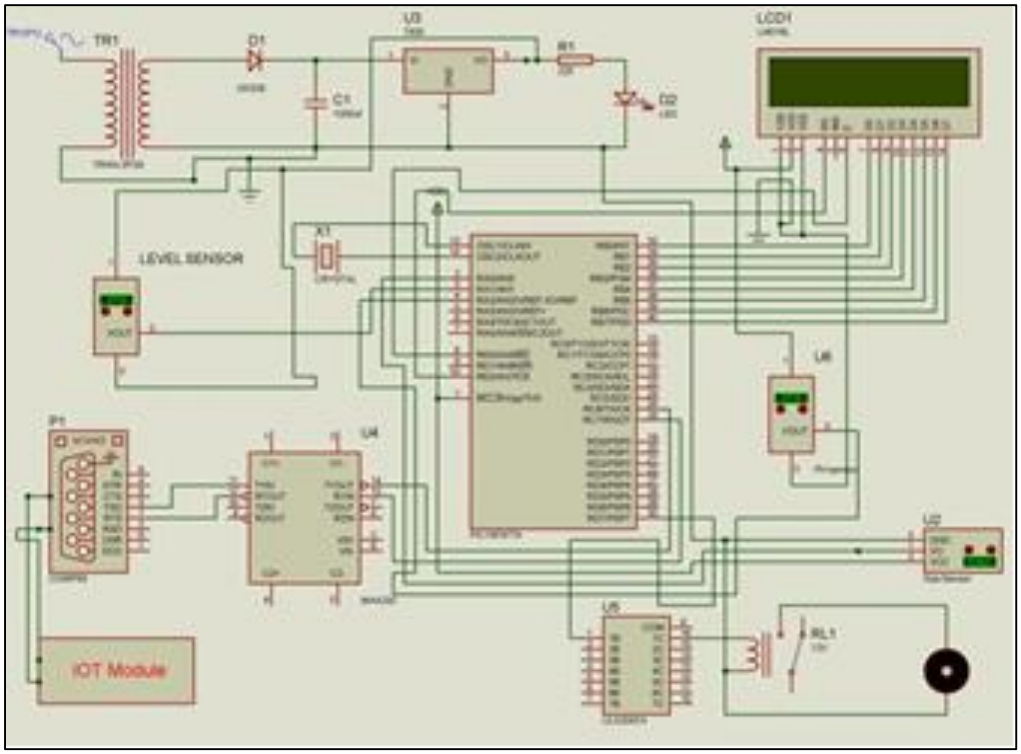


Fig. 3: circuit diagram

IV. DESCRIPTION OF THE BLOCK DIAGRAM

A. Water Level Sensor

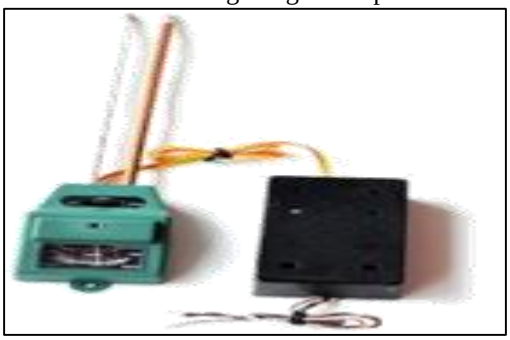
Level sensors detect the level of substances that flow, including liquids, slurries, granular materials and powders. The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place. While point-level sensors only indicate whether the substance is above or below the sensing point generally the latter detect levels that are excessively high or low.

B. Gas Sensor MQ-2

The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place. While point-level sensors only indicate whether the substance is above or below the sensing point generally the latter detect levels that are excessively high or low.

C. Ph sensor

A P_h sensor is a device that measures the hydrogen -ion concentration (ph) in a solution, indicating its acidity or alkalinity. In addition to measuring the ph of liquids, it can also measure the moist and light level. The ph sensor has an inbuilt meter to measure the light intensity. The ph sensor is connected with a board to get digital output.



D. LCD Interface

It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The LCD display requires data in a serial format. The display also requires a 5V power supply. The power shouldn't excee d 5V, as this will cause damage to the device. The 5V is best generated from the E-blocks Multi programmer or a 5V fixed regulated power supply. The 16 x 2 intelligent alphanumeric dot matrix displays is capable of displaying 224 different characters and symbols.

E. IOT Module

IOT has evolved from the convergence of Wireless technologies, microelectromechanical systems (MEMS) and the Internet. Internet of Things (IoT) is an environment in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. IoT board featured with SIM900 GPRS modem to activate internet connection also equipped with a controller to process all input UART data to GPRS based online data. Data may be updated to a specific site or a social network by which the user can able to access the data.

F. DC Gear Motor

Geared dc motors can be defined as an extension of dc motors A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed.

Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. A DC motor can be used at a voltage lower than the rated voltage. But, below 1000 rpm, the speed becomes unstable, and the motor will not run smoothly.

G. Relay

A relay is an electromechanical switch which is activated by an electric current. A single relay board arrangement contains driver circuit, power supply circuit and isolation circuit. A relay is assembled with that circuit. The driver circuit contains transistors for switching operations. The transistor is use for switching the relay. An isolation circuit prevents reverse voltage from the relay which protects the controller and transistor from damage. The input pulse for switching the transistor is given from the microcontroller unit. It is used for switching of a single device.

V. EXISTING SYSTEM

The water is monitored for quality by collecting samples and these samples are sending to laboratories for analysis. The estimation of water parameters such as ph, water level and gas are measured with the help of meters. So the disadvantage is that there is no continuous monitoring of water at the source of the water resource, less reliable, requires human resources. The wastage of water

is also not minimized. The frequency of monitoring and testing is very low. Due to these disadvantages, the existing system is required to develop a system that will allow continuous monitoring of water.

VI. PROPOSED SYSTEM

Sensors will form the primitive part of the proposed work. They are being used to monitor the water quality parameters. Sensors will be immersed in the storage tank. The parameters such as level get converted into electrical quantity. The parameters that area measured can be viewed using LCD. To facilitate the communication between the sensors and the IoT module we use UART protocol. The IoT module consists of three major components the PIC microcontroller, GSM modem and a GSM module. Here we use the software MPLAB IDE and Pickit-3.The major task carried out here is reading the data from the sensor, processing them and sending it to the cloud data storage. The controller and the cloud storage base interacts through long range communication standards such as the internet with the help of SIM card that is mounted within the IoT module ,which facilitates for remote system monitoring. Two services will be provided. A website will be created consisting of two pages namely monitor and control. The monitor page gets updates continuously about the parameters and acts as a log. The control page will consist of switches to alert the user and whether to turn on/off the motor adhering to the prescribed measurements so that they don't exceed the threshold. Another service is the development of an android application that helps the user and the authorities to view the parameters and control the motor from anywhere.

VII. CONCLUSION

The paper proposes the development of a water monitoring system based on wireless sensor networks which monitors the water quality for domestic usage and industrial purposes. Central base stations and nodes are connected through IOT module and base station is interfaced to internet so that the users can login and get real time water quality data. Future works include using algorithms to extend network to a wide area. A future work also lies on integration of turbidity sensor, dissolved oxygen sensor and color sensor to the sensors used in this work.

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