

Water Management System Using Dynamic IP based Embedded Webserver in Real-time

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ABSTRACT

The intended system means to create a Water Management System which can result in frequent monitoring of the water quality. System management of water supply using dynamic IP based Embedded Web Servers presented in this paper. To maintain a EWS with static Internet Protocol (IP) is costly and difficult to manage. Dynamic IP is obtained for embedded board by enabling General Packet Radio Service (GPRS) of USB data card through point to point protocol daemon (PPPoE). Embedded board having dynamic IP contains in file transfer to server through Bash scripts and C language. The system is meant to be an important tool for evaluating water quality and a valid support to strategic decisions concerning critical environmental issues.

Keywords : Smart Sensor; Real-time Embedded Web Server; Wireless Sensor Networks; GPRS

I. INTRODUCTION

Water, a basic need of any living thing plays a major role for survival. The system should merge communication, network, internet and integrated technology together to bring a proper development in this field. An IP based Embedded Webserver (EWS) is used for this purpose. There is no need of manual labours to monitor. This result is lesser manpower need and higher accuracy of results. Monitoring and controlling of the system using internet based technology makes it easier to get data using a standard web browser[1][2].

There is an IoT device involved to send notifications regularly to a particular assigned to the government officials. Development in integrated technology fulfils requirement of the data acquisition, such as cost, size [3]. If the water pH level increases, the message will reach a common website for the sector as a backup message delivery point to the government if the IoT message does not deliver.

II. METHODS AND MATERIAL

A. Related Works

Another work previously carried out involves use of zigbee which is a disadvantage to the system for the fact that it does not have efficient message delivery properties. This cannot deliver the message to the user assigned anywhere or anytime. EWS with embedded database is used in mobile phone is introduced [7] and most systems uses ethernet to access internet. The message passing can only be done within a particular range of distance. The paper [3] explains real time bidirectional interaction with low cost solution but access data on demand. In available, various low-cost webserver were designed using ethernet and lan, but these are based on static IP with no explanation of real time data [2][3][6]. Hence, cannot allows real time monitoring and controlling of data. The water quality in urban areas is monitored manually. The current system uses zigbee technology for monitoring. This cannot be accessed or can be monitored anywhere or anytime as we perform over the internet. This increases the chance of regular monitoring of the water resources in urban areas

B. Methodology

The methodology carries a sequence of process which first involves the pH scale to be immersed into the water that needs to be tested. The pH scale shows the degree of acidity in the water that is tested. The reading is taken and is sent to the analog and digital converter. This is done because the controller can understand only binary values. The controller acts as a central of medium and passes the pH reading to the Universal Asynchronous Receiver and Transmitter (UART). The UART is used in this system as the IoT can only understand serial signals.

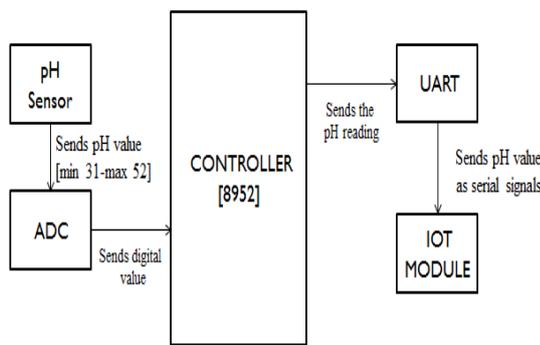


Figure 1. Workflow of the system

The UART sends the pH value to the IoT module. The IoT module is a 2G device. It sends the report of the water quality to the assigned government officials as a text message and also updates the message over the website that is created for this purpose.

Zigbee is an IEEE 15.4 based system which is used for high level communications protocols to create small range of communication network. Zigbee can be easy to implement and also less expensive such as Bluetooth or a WiFi device. It is very powerful when used for wireless light switches, electrical meters with in-home displays, traffic management systems, etc. Zigbee is power saving , reliable, low cost, short time delay, large network capacity and safe but the main disadvantages of zigbee includes short range ,low complexity, low data speed . the short range serves as a major disadvantage as the user cannot access the data whenever or wherever needed. The low data speed is also a problem for users who want to transmit large amount of data.

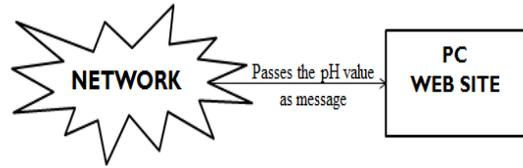


Figure 2. Path of pH value to Website

Internet of Things (IoT) is a network of various devices which is based on embedded systems. The IoT enables these objects to collect and exchange data through a network. These objects are allowed to be sensed and controlled remotely with across a network infrastructure. This creates more direct integration of the physical world to the embedded systems. This will result in improved efficiency, high accuracy and more economic benefits. This is a futuristic technology which connects the internet and the devices for the purpose of communication. The objects or machines will able to exchange messages, eliminating the interference of the humans. These objects which are involved in message exchange contain embedded technology where radio frequency identification, wireless technologies, QR (Quick Response) codes are used as means of communication. Every device consists of a unique IP address over the internet.

The major advantage of IoT is that the automation of daily task leads to better monitoring and transparency with QoS(Quality of Service). It also efficient and saves time. IoT as optimum utilization of energy and maintenance cost is low. Hence, saving money. All the applications of this technology provide better management, increased comfort, improved quality of life. This is why IoT technology is used over the proposed system.

pH is a numeric scale which is used to specify whether the aqueous solution is acidic or basic. pH is defined as the decimal logarithm of the hydrogen ion activity's reciprocation.

$$\text{pH} = -\log_{10}(a_{\text{H}^+}) = \log_{10}(1/(a_{\text{H}^+}))$$

pH value from 0-6 is said to be acidic. The pH value 7 is a neutral value. The pH value is said to be basic when the result is between 8-14.

The message passing happens over a network which can be accessed anywhere and anytime. This is the main advantage of the system.

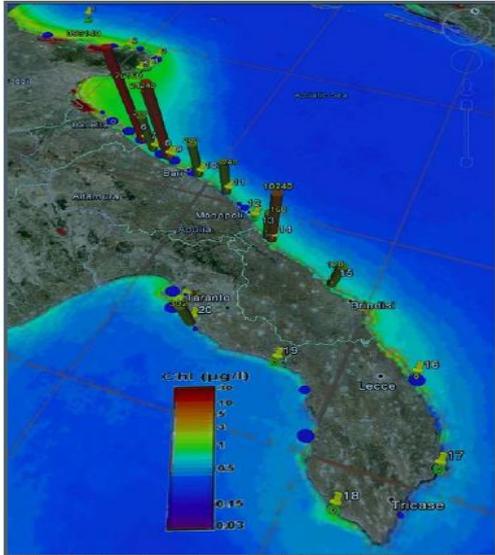


Figure 2. pH reading in the water resource

The above shown is the representation of the pH scale reading over a water resource. The device used to send and receive the IoT message is shown below:



Figure 3. Board of the Water Management System

C. Methods

1. Sensor

The main aim of the sensor module is to convert the physical quantity of work to a digital value. This is done using the analog to digital converter (ADC). The water sample taken from the water resource that is to be tested for quality is tested with a pH scale reader. The reader takes in the degree or acid or basic entities. This will be recorded and sent over to the ADC. This value is converted to digital value and is passed on to the micro controller. Then this value is compared with the standard value to analyse the quality of the water resource.

2. Message

This system involves passing the resultant messages to the necessary officials. The digital message acquired is compared to the standard value and if the result is neutral, this system does not take any action. If the pH scale result is not positive to the quality of the water resource, the notification message is sent from an IoT device in two ways. The first is to send a text message to the government officials and the second is to update the status of the water resource over a common website.

3. Update

After the IoT device sends the result as a message and updates to the website, the assigned government officials will be able to get access to the pH result of the water result that has been tested. Using this, the concerned official will be able to analyse and take the necessary actions to rectify the problem.

D. Techniques

1. OFDM

Orthogonal Frequency-Division Multiplexing (OFDM) is a technique of encoding digital data in multiple carrier frequencies. OFDM is a Frequency-Division Multiplexing (FDM) method used as a digital multi-carrier modulation. A large number of closely spaced orthogonal sub-carrier signals are present. These are used to carry data on several parallel data streams or data channels. Each sub-carrier is modulated with a conventional modulation method at a low symbol rate, maintaining total data rates related to conventional

single- carrier modulation techniques in the same bandwidth.

2. GPRS

GPRS stands for General Packet Radio Service. It is a packet oriented mobile service based on 2G and 3G cellular data communication which uses GSM. It uses packet switching technology and provides high speed wireless IP [6]. GPRS usage is charged based on the amount of data that is transmitted and received. This will involve upload, download, internet usage due to browsing, maps, etc., GPRS supports IPV4 and IPV6, point to point protocol, X.25 connection, TCP/IP communications. The maximum speed of GPRS connection in 2G cellular data is 32-42kbps. GPRS has become more widely available to the users of VPN. GPRS also compliments Bluetooth which is a standard method for transmitting data without any wired connection. AT command send out through serial port receive by processor complete the task of transmitting and receiving data to GSM network.



Figure 4. View of water resource with resultant values

3. DIGITAL

A computer cannot understand the analog data's that a human can understand. This leads to need of an intermediate system which functions understandable to both. This is where digital or binary languages involved. Digital language is a container of binary values. These binary values are arranged in many possible ways to

create a proper understandable language. The ADC performs the conversion of analog to digital values of any data that is given by the user.

III. RESULTS AND FUTURE ENHANCEMENTS

The system applies to the officials to know the pH value results anywhere using the IoT message that is being automatically transmitted. This serves as an efficient system to get quicker results. The IoT technology serves as a major advantage of this system as the user will be able to access the data from anywhere. The pH results are updated in both a website and as a text message to every assigned individual.

In future, this can be applied to the air pollution issue to control the pollution due to various resources.

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