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Automatic evaluating of water quality based high speed networking

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Abstract*—In many developing countries bulk of domestic and industrial wastewater is discharged without any treatment or after primary treatment only this adversely affect the environment, In addition marine water bodies or areas where the discharge of industrial wastewater does adversely affect the marine living beings. To care our environment as well as our health we should keep our environment clean.Domestic water treatment removes physical, chemical and biological contaminants from wastewater. This treatment should be implemented in all industries throughout the world. So we are aimed to create a system to monitor the industrial discharged waste water contaminants automatically and transmit the result to authorized person so that action will be taken by the government.

***Index Terms*—Bacteria, coliforms, disposable electrodes, embedded system, impedance, portable sensor.**

I. INTRODUCTION

Environment pollution is due to various factors some of them are air, water, noise. In this paper we concentrate on water pollution, its effects and how to control it. Nowadays there are many factors which contaminate water such as industrial and domestic waste. This leads to serious issues risking human life. Various water borne diseases spread due to water pollution which endanger human life. Industrial waste water contains lot of chemicals in it, usually it get discharged into the sea, it affects the sea breeds. This affected sea fishes finally reaches human. This is a serious issue and must be avoided. The industrial discharged waste water should be tested before it is released from the industry so that the environment will not be polluted. There are various electronic technologies available in the market composed with embedded systems and wireless technology. The embedded system technology is one of the highest growth areas because these systems are used in each and every market segments now days like electronics, automation, biomedical, wireless communication and using wireless and embedded systems we can design a system to automatically check the contaminant level in the industrial discharged waste water and report it to the concerned official so that action will be taken immediately.

II. RELATED WORK

The traditional method of water quality testing is to collect samples manually and then send them to laboratory for analysis. However, it has been unable to meet the demands of water quality monitoring today. For that we need to appoint staffs to follow the industrial activities and also that not good method due to the absence of reliability. In our proposed system we made those things automatically. Also the water quality management system is manual updated, which lead to human negligence and cause to death. By political and financial power the water quality management system is misused. In our system each and every individual water meter is been grouped by an individual network called WPAN (Wireless Personal Area Network).WPANs have emerged as a new class of systems that leverage the power of distributed computation,sensing,and actuation towards a host of scientific,military,and engineering applications. However, engineering these systems is not without challenges. As described therein, from the get go, energy has been identified as the single most important resource for this class. Furthermore, communication is recognized as the most demanding operation on this resource, and a number of designs have been proposed.

III. HARDWARE SETUP

A. Block Diagram

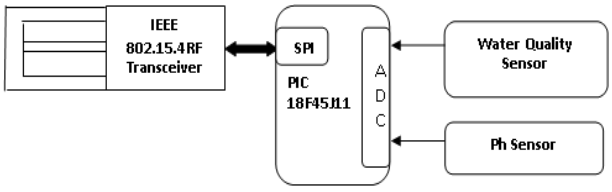

Fig 1. Industrial set up

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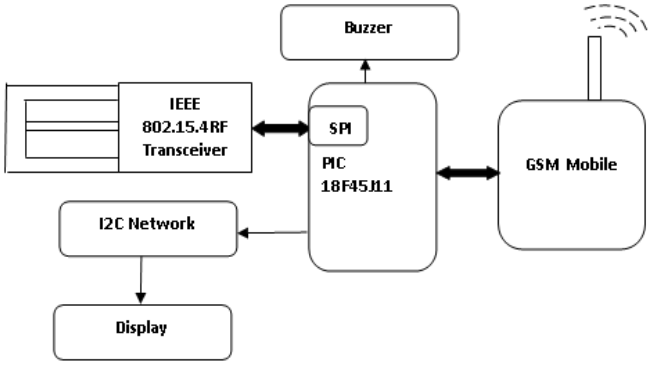

Fig 2. Monitoring section

B. PIC microcontroller

- Timer1 Oscillator/w RTCC: 1 µA, 32 kHz
- Watchdog Timer: 2.2 µA, 2V Typical.
- 5.5V Tolerant Inputs (digital only pins)
- Low-Power, High-Speed CMOS Flash Technology
- Priority Levels for Interrupts
- Self-Programmable under Software Control
- 8 x 8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT)
- 5 Ports A,B,C,D,E
- Timers- 5

C. PH Measurement

A pH measurement loop is made up of three components, the pH sensor, which includes a measuring electrode, a reference electrode, and a temperature sensor; a preamplifier; and unanalyzed or transmitter. A pH measurement loop is essentially a battery where the positive terminal is the measuring electrode and the negative terminal is the reference electrode. The measuring electrode, which is sensitive to the hydrogen ion, develops a potential (voltage) directly related to the hydrogen ion concentration of the solution. The reference electrode provides a stable potential against which the measuring electrode can be compared**.**

When immersed in the solution, the reference electrode potential does not change with the changing hydrogen ion concentration. A solution in the reference electrode also makes contact with the sample solution and the measuring electrode through a junction, completing the circuit. Output of the measuring electrode changes with temperature (even though the process remains at a constant pH), so a temperature sensor is necessary to correct for this change in output. This is done in the analyser or transmitter software.

The pH sensor components are usually combined into one device called a combination pH electrode. The measuring electrode is usually glass and quite fragile. Recent developments have replaced the glass with more durable solid-state sensors. The preamplifier is a signal conditioning device. It takes the high-impedance pH electrode signal and changes it in to allow impedance signal which the analyser or transmitter can accept. The preamplifier also strengthens and stabilizes the signal, making it less susceptible to electrical noise.

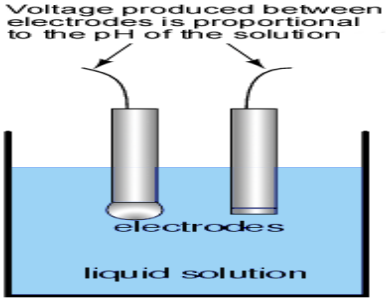

Fig 3. PH Measurement

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The design and operational theory of pH electrodes is a very complex subject, explored only briefly here. What is important to understand is that these two electrodes generate a voltage directly proportional to the pH of the solution. At a pH of 7 (neutral), the electrodes will produce 0 volts between them. At a low pH (acid) a voltage will be developed of one polarity, and at a high pH (caustic) a voltage will be developed of the opposite polarity.

D. IEEE 802.15.4 Transceiver

IEEE 802.15.4 is a standard which specifies the physical layer and media access control for low-rate wireless personal area networks (LR-WPANs). It is maintained by the IEEE 802.15 working group, which has defined it in 2003. It is the basis for the Zig Bee, ISA100.11a, Wireless UART, and MiWi specifications, each of which further extends the standard by developing the upper layers which are not defined in IEEE 802.15.4. Alternatively, it can be used with 6 LoWPAN and standard Internet protocols to build a wireless embedded Internet. IEEE standard 802.15.4 intends to offer the fundamental lower network layers of a type of wireless personal area network (WPAN) which focuses on low-cost, low-speed ubiquitous communication between devices (in contrast with other, more end-user oriented approaches, such as Wi-Fi). The emphasis is on very low cost communication of nearby devices with little to no underlying infrastructure, intending to exploit this to lower power consumption even more. The basic framework conceives a 10-meter communications range with a transfer rate of 250 kbit/s. Tradeoffs are possible to favor more radically embedded devices with even lower power requirements, through the definition of not one, but several physical layers. Lower transfer rates of 20 and 40 kbit/s were initially defined, with the 100 kbit/s rate being added in the current revision. Even lower rates can be considered with the resulting effect on power consumption. As already mentioned, the main identifying feature of IEEE 802.15.4 among WPANs is the importance of achieving extremely low manufacturing and operation costs and technological simplicity, without sacrificing flexibility or generality.

Important features include real-time suitability by reservation of guaranteed time slots, collision avoidance through CSMA/CA and integrated support for secure communications. Devices also include power management functions such as link quality and energy detection. IEEE 802.15.4-conformant devices may use one of three possible frequency bands for operation. In this project we use the transceiver for communication between the handheld and the footwear unit. This kind of wireless communication is done with the help of this wireless communication.

E. SUPPORTED TOPOLOGIES

IEEE 802.15.4 supports two topologies: Star and Peer-to-Peer. A typical star topology is shown in Figure5. From a device role perspective, the topology has one Personal Area Network (PAN) coordinator that initiates communications and accepts connections from other devices. It has several end devices that join the communication. End devices can establish connections only with the PAN coordinator. As to functionality type, the star topology's PAN coordinator is a Full Function Device (FFD). An end device can be an FFD with its radios on all the time, or a Reduced Function Device (RFD) with its radio off when it is Idle. Regardless of its functional type, end devices can only talk to the PAN coordinator.

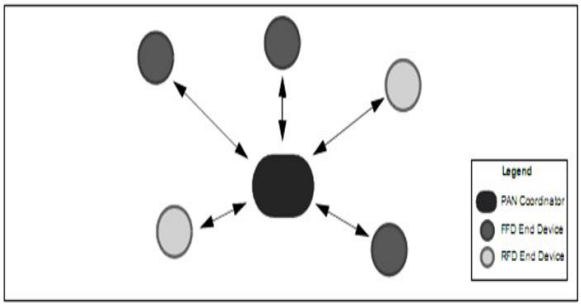

Fig 5. Star Topology

A typical P2P topology is shown in Figure 6. From a device role perspective, this topology also has one PAN coordinator that starts communication and the end devices. When joining the network, however, end devices do not have to establish their connection with the PAN coordinator. As to functional types, the PAN coordinator is an FFD and the end devices can be FFDs or RFDs. In this topology, however, end devices that are FFDs can have multiple connections. Each of the end device RFDs, however, can connect to only one FFD and cannot connect to another RFD.

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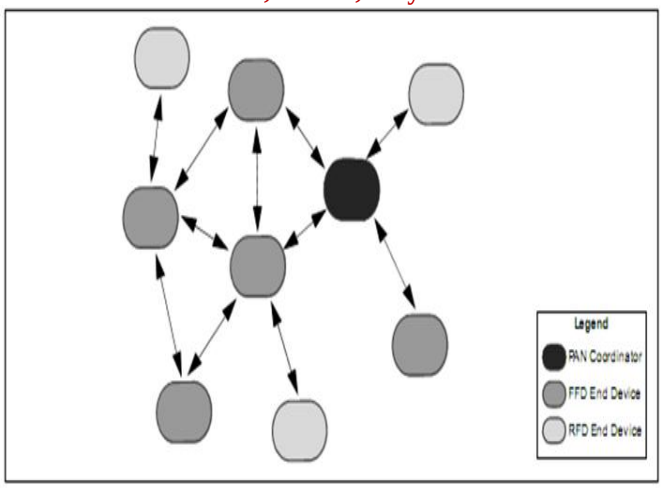

Fig 6. Peer to Peer Topology

F. PCB Antenna

The PCB antenna is fabricated on the top copper trace. The layers below the antenna have no copper traces. The ground and power planes under the components serve as a counterpoise to the PCB antenna. Additional ground plane on the host PCB will substantially enhance the performance of the module. For best performance, place the module on the host PCB following the recommendations in "Mounting Details".

The Printed Circuit Board (PCB) antenna was designed and simulated using Ansoft Designer ® and HFSS 3D full-wave solver software by Ansoft Corporation (www.ansoft.com). The design goal was to create a compact, low-cost antenna with the best radiation pattern. The performance of the antenna is dependent upon the orientation of the module.

Fig 7. PCB Antenna

G. FEATURES OF LCD

- Operating voltage range is 3-20V ac.
- Response time is 50 to 200 ms.
- Viewing angle is 100 degree.
- Invisible in darkness. Requires external illumination.
- Life time is limited to 50,000 hours due to chemical graduation

H. I2C Protocol

The I²C -bus is a multi-master bus. This means that more than one device capable of controlling the bus can be connected to it. The possibility of connecting more than one microcontroller to the I²C -bus means that more than one master could try to initiate a data transfer at the same time. To avoid the chaos that might ensue from such an event - an arbitration procedure has been developed. This procedure relies on the wired-AND connection of all I²C interfaces to the I²C -bus. If two or more masters try to put information onto the bus, the first to produce a 'one' when the other produces a 'zero' will lose the arbitration. The clock signals during arbitration are a synchronized combination of the clocks generated by the masters using the wired-AND

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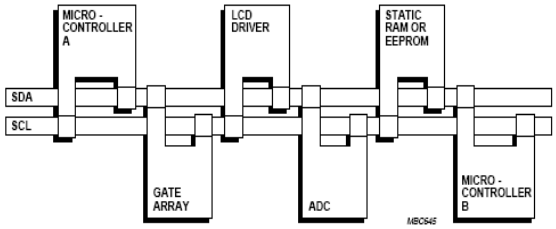
connection to the SCL line. Generation of clock signals on the I²C -bus is always the responsibility of master devices; each master generates its own clock signals when transferring data on the bus. Bus clock signals from a master can only be altered when they are stretched by a slow-slave device holding-down the clock line, or by another master when arbitration occurs.



Example of an I²C-bus configuration using two microcontrollers.

IV. PROPOSED SYSTEM

Each unit is fixed with Ph Electrodes and water purity sensor.A group of industries are monitored, so we go for networking. It is a wireless communication with N number of nodes can be connected to form a network. If any abnormality occurs, the server unit will send the SMS to the authorized person, with details like ph level of the industrial waste water.

The system consists of multiple sensors of water quality testing, single-chip microcontroller data acquisition module, information transmission module, monitoring center and other accessories. Various parameters of water quality are automatically detected under the control of single chip microcontroller all day. The single chip gets the data, and then processes and analyzes them. After that, the data are instantaneously sent to monitoring center by GSM network in the form of SMS. If the water quality is abnormal, the data will be sent to monitoring center and management's mobile in the same way at the same time. It is convenient for management to take corresponding measures timely and be able to detect real-time situation of water quality remotely. It is characterized by advantages of shortcut, accuracy and using manpower and material resources sparingly.

V. RESULTS

- The performance of the system is assessed based on two key elements: sensor reliability and communication reliability.
- Data was determined as correct based on the physical behavior of the subject under test in a controlled environment.
- The sensor reliability was calculated by finding the ratio of the number of correct data (right status under the controlled environment tests) received to the total number of received data.
- Severe damage and failures can be avoided and treated properly without much cost and reliable approach to solve the problem.
- Field trails prove that this approach can be adopted in all sorts of environments.

VI. CONCLUSION

Our ultimate goal is to reduce time consumption for evaluating the results. Also to avoid the manual work involved in this process. Microcontroller is used to monitor the result properly and send the result to authorized person. Embedded systems are rapidly growing in all sectors. So by using real time embedded systems can achieve the auto self-monitoring and alert system efficiently and accurately. The future we can enhancement by connecting to the internet server and can control the industries water which is supplied to the industries and control the wastage of water and increases overall project efficiency. Since all the industries are connected in network we can identify and take action on individual industries

The challenges and difficulties of deployment of sensors and IEEE801.15.4 protocol in practical scenarios have been identified. Measured the performance of the sensors based on battery life as well as communication and sensing reliabilities. The proposed work has overcome the disadvantages of the existing scheme.

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