Cost Effective water Quality Monitoring System for Rural Areas

Anushree R
Assistant Professor, Department of ECE
SJB Institute of Technology,
Bangalore, India

Nikita R Kashampurkar
MTech. student, Department of ECE
SJB Institute of Technology,
Bangalore, India

Abstract:- The main aim here is to design a system for monitoring the quality of the water. This type of monitoring is required everywhere but especially in rural areas, as there the environment where people stay is more polluted and dirty. The places where garbage is mixed with water is the major concerned area of the project. Here it is tried to develop a real time water quality monitoring system which could help not only urban but also in rural areas. This kind of monitoring is necessary as if not done may affect the health of the people staying in such kind of polluted areas. This system is developed using ARM7, sensors, and a personal system which is PC. The core component used here is ARM7 which is programmed using c language. The developed system will tell about few basic parameters which informs about water's quality and these parameters are pH level of water, level of water, temperature of water and even carbon dioxide on surface of the water.

Keywords— Water quality monitoring; Arm7; Embedded C language; GSM module.

I. INTRODUCTION

The work here is done on the design and implementation of the water quality monitoring system and hence notifies with the real time water quality parameters. Here the physiochemical parameters of water quality can be measured such as ph. level, flow and temperature. The sensors are designed and implemented using signal conditioning circuits are connected to microcontroller. Zigbee receiver and transmitter are used to connect the measuring and notification end. [1]. An industrial wireless sensor network(WSN) in environment of internet of things is used to develop a sensor interface device for sensor data acquisition. Audino Uno is used here as the core component which scans the information with high speed in parallel and in real time. Intelligent device interface specification is adopted here. By detecting the sensor values it can easily sense about the temperature, humidity and gas present in the industrial environment [2]. Many communities are vigorously researching to contribute on the domain internet of things. A basis on how Iot can be understood a research has been tried to be provided on problems in Iot and a vision on how Iot can change the world has also been explained [3].

Many technical and application challenges are being faced by the internet of the things as Iot is creating many billions or trillions of networks being communicating with each other. Even the purposes of an internet of things architecture are known here which consists of three platforms to meet its challenges. The opportunity and prospects of the Iot are mentioned here [4]. The measurement of quality of water is done by gathering the samples manually and then sending to laboratory for analysis but this is not economical at all. The system consists of multiple sensors for water quality measurement, microcontroller and gsm for sending the information to watching centre. It is the system which measures the quality each time and sends the same to watching centre every time[5]. Health of the creatures are to be taken care of and for that the freshwater qualities have to be monitored in the absence of direct human impact. A real time device for direct monitoring of physical and chemical parameters is presented using aurdino microcontroller. The device is designed for domestic purpose with more importance being given to cost and power consumption [6]. A device for interfacing sensor is used to collect the sensor data of industrial wireless sensor networks in Iot environment. Here complex programmable logic device(CPLD) is used as a core device to solve the issues in industrial areas. The standard of IEEE.1451.2 intelligent sensor interface is used here. It stipulates the sensor hardware and software design of the interface to know the acquisition of sensors. Performance is verified, and proper implementation is done here for water environment monitoring [7].

II. HARDWARE REQUIREMENTS

The hardware components that are used here in the implementation of the system can be given as follows:

A. Temperature sensor

Here a temperature sensor is used which is basically a Lm35.This is the one which when dipped in water gives the relevant results about the temperature of the water on time to time basis. This is the information which is required to test if it is hot, cold or normal one and further actions can be then taken accordingly.

B. pH sensor

The pH sensor that is used here is nothing but the pH meter which when dipped inside the water gives the appropriate pH level of the water. This helps in knowing if the water that is available to drink is either acidic, alkaline or pure. On knowing this water condition will be known and can be further treated accordingly.

C. CO_2 sensor

The sensor called as carbon dioxide sensor used to check in with the carbon dioxide level in the water. As many of the aquatic creatures will be requiring the amount of oxygen for their living inside the lakes or seas. This hence tell the amount of carbon dioxide level in the contaminated water so as to protect the proper measurements to save those creatures.

D. Relay.

A relay is basically the electrical switch which can be used for opening and closing the circuit under the control of another electrical circuit. These are basically used to make sure that the amount of power which flows is the one which is required by the circuit. These are basically for protection purpose basically from any faults or high power.

E. GSM module

The Gsm module is used here for the communication between the mobile and the GSM system. This module is basically used for the tradeoff between the implemented or designed module with the mobile for sending the levels or readings of the water on regular basis.

III. IMPLEMENTATION AND WORKING OF ARCHITECTURE

Here we try to implement a system for the monitoring of the quality of water. Nowadays, monitoring of waters quality has become a quiet essential task as this is directly affected to the help of the human being and even to the aquatic creatures present inside the water. Water contamination is an issue nowadays which costs human health in turn. To lower the risk of one's life we must check with the purity of the areas as the common man is dependent on lakes, seas for daily consumption of water. There must be some proper system developed for the testing of water firstly and then further step could be taken by the authorities on providing pure or drinkable water to the common man who cannot afford of any purifying system for their drinking.

The architecture which is fig 1 here basically shows the implementation of the system which is used for monitoring the water quality. Here sensors which are used are temperature sensor, pH sensor and carbon dioxide sensor. These are the major factors to be looked on up to when considered the quality of water. The interfacing of the sensors is done to the ARM7 microcontroller. The sensors when interfaced to the controller gives the appropriate readings after that. Hence interfacing is done to receive the outputs from sensors. Usually power supply is used when the system has to be started up or to initialize the system implemented. The readings are displayed on the LCD screen here. This LCD screen must also be interfaced to the controller to receive the proper readings from the sensor and thus display it on the screen.

ARM7 is used as a major component here due to its portability, low cost and low power consumption. It can be used for many functions to be performed on real time basis. Here a relay is used as it acts as a switch and allows only so much of current to pass through as much required. The led on the relay gets on whenever the water is normal and thus gets off when water is acidic. Even the buzzer used here makes noise whenever the pH of water is acidic and stops itself whenever the pH of water is normal. Likewise, when water is hot it makes noise telling temperature is increased. The GSM module is used for communication based on mobile. It sends the messages to the mobile on the real time basis. Whenever the temperature and pH level vary, continuous messages will be coming on the mobile phone. Messages keeps on coming when the temperature comes to some ideal state. The GSM is used here as it has a specialty of having high range of connectivity when compared. In some countries GSM is the only technology used for communication purpose.
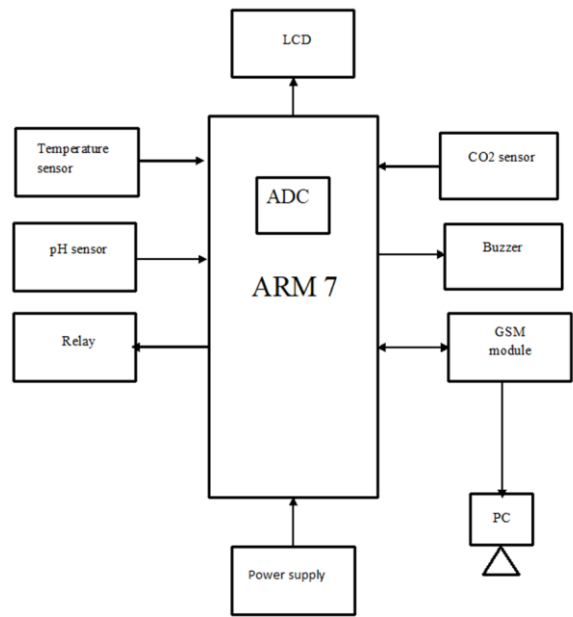

Fig 1:- Block diagram of the water quality monitoring system

IV. SOFTWARE IMPLEMENTATION

The interfacing must be done here after the connections are done with. The embedded c is the language used for the interfacing of the components with the controller which is ARM7 here. Embedded C is the one used as the language because of its simplicity and more easily understandable feature within it. It has the capability of supporting more number of features with used by embedded systems. The program is stored in the Kiel software. The Kiel micro vision 4 software is used here. This kind of IDE environment is used here as it is the most compatible one to specially lpc2148. Once the program is dumped and stored it is built and then the program is run. Then the program must be checked for errors and then the interfacing is carried out here. Here more number of applications are provided with which can be used for carrying out for different application oriented development. The flash magic is the tool used for interfacing the program with the controller. Flash magic the software which is provided by embedded systems and this is the one which helps to access the features that are provided by some other devices when connected to it. This is the tool which converts the file containing program to hex and then the respective file is dumped on to the device that it is getting interfaced to. The major feature of this is that it is user friendly and can be easily understood by the one using it. Here lpc2148 is used as the controller which is thus interfaced via the tool which is flash magic. Thus the interfacing of the hardware module of monitoring about the quality of the water is carried on using the Kiel platform and flash magic tool.

V. RESULTS AND DISCUSSION

The monitoring system is tried to be developed here and the process goes on this way. Fig. 2 shows the developed system here. Once all the components are arranged and interfaced properly then the functioning of the system would initialize. The GSM starts initializing the developed design and then sensors are checked in with the results. Firstly, the temperature sensor is dipped in inside the water and checked for the present temperature condition of it. The Fig. 3 here depicts the one example how temperature is displayed on the lcd display. Then later pH sensor can be dipped in and this displays the actual level of water and mentions if its acidic or normal. Fig. 4 depicts this case. Then carbon dioxide sensor senses its level and display if its detected or not. Fig 5 depicts the display of it on the lcd.All these measures are required for the monitoring of proper water quality that is usually being consumed. This system can be used for the areas which are basically rural and their affordability when related to the drinking of the water is low. Hence if designed such a system is can be developed with low amount of cost will help the people for their proper and healthy living.

Fig 2:- The proposed system

Fig 3:- Temperature of the water

Fig 4:- pH of the water

Fig 5:- depicts when carbon dioxide is detected

VI. CONCLUSION

This kind of system is thus designed and helped for the people staying in the rural areas where no proper availability o the water for drinking will be there. They have no other option but to drink water from lakes, seas and many other natural resources which are not even assured to be clean to be drinkable. Thus, this could at least help the people and even the water control board for knowing the actual condition of the water at that place so that some measures could be taken to overcome this issue and develop some kind of purification system that could reduce the life risk of the people staying around.

REFERENCES

[1]. Niel Andre Cloete, Reza Malekian, "Design of Smart Sensors for Real-Time Water Quality Monitoring," IEEE access, vol.4,, pp. 529-551,

[2]. Kallappa, B. B. Tigadi, Industrial Safety Parameters Monitoring in IOT Environment, IJAREEIE ,Vol. 5, Issue 6, June 2016, pp.5511-16.

[3]. John A. Stankovic, Life Fellow, "Research Directions for the Internet of Things," in IEEE internet of things journal, Volume: 1, Issue: 1, Feb. 2014, pp. 3-9.

[4]. Shanzhi Chen, Senior Member, IEEE, Hui Xu, Dake Liu,Senior Member, IEEE, Bo Hu, and Hucheng Wang, "A Vision of IoT: Applications, Challenges, and Opportunities With China Perspective," IEEE internet of things journal, vol. 1, no. 4, august 2014.pp.349-359.

[5]. Akanksha Purohit1, Ulhaskumar Gokhale, "Real Time Water Quality Measurement System based on GSM," in IOSR-JECE., .Volume 9, Issue 3, Ver. V ,May - Jun. 2014, pp. 63-67.

[6]. N. Neha Beri, "Wireless Sensor Network Based System Design for Chemical Parameter Monitoring In Water," IJECSCSE Volume3,Issue6 pp.1-8.

[7]. Qingping Chi, Hairong Yan, Chuan Zhang, Zhibo Pang, and Li Da Xu,"A reconfigurable smart sensor interface for industrial WSN in IOT environment.",IEEE transactions on industrial informatics,vol 10.,NO. 2,May2014pp.1417-1425.

[8]. Akyildiz,I,F.;Su,W.; Sankarasubramaniam,Y.; Cayirci,Y., "Wireless Sensor Networks: A Survey", Computer Networks, vol.38, pp. 393–422, 2002.

[9]. W. R. Heinzelman et al., ''Adaptive Protocols for Information Dissemination in Wireless Sensor Networks,'' Proceedings of the 5th ACM/IEEE International Conference on Mobile Computing and

Networking (MobiCom'99), Seattle, WA, Aug. 1999, pp. 174-185.

[10]. Broring, A. et al., "New Generation Sensor Web Enablement" Sensors, vol.11, 2011, pp. 2652-2699. ISSN 1424-8220. Available at doi:10.3390/s110302652

[11]. Sharma,H and Sharma,S., "A Review of Sensor Networks: Technologies and Applications", in Engineering and Computational Sciences (RAECS), 2014 Recent Advances in, Chandigarh, pp.1–4, 2014.