RIVER MONITORING THROUGH WIRELESS SENSOR NETWORK

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Abstract

WSN system is the recent and cost effective system for monitoring and controlling the environmental applications. It is also a demanding task to use efficiently the energy harvesting system (EHS) technology for WSN. The system performs the measurements using integrated peripherals to process the measured data as well as to co-ordinate the data transport of the WSN to work. Basically River mote is a case study for designing a low cost hardware system architecture combining low-power mote and a highly efficient EHS architecture. The main requirement of this system is continuous operation using Energy Harvesting System. The work includes first the water level monitoring platform using only the ultra-sonic sensor and second the PH balance to know the toxicity present in water. This system provides a real-time guidance to those industry that depends on regional water quality conditions like industry, agriculture, aquatic life etc.

Keywords: *Energy Harvesting system (EHS), Zig-Bee module, Ultrasonic sensor, Ph sensor, Wireless sensor network (WSN).*

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1. INTRODUCTION

The earth's surface consists of 71 % of water in it. Water plays a very important role for all living being, but due to growing industries and technical life style the water is getting polluted by man. The environmental monitoring system ie the water monitoring system is hence a recent technology that helps to control water pollution. In previous days man himself had to check the pollutant contents as well as the level using handheld devices as shown in fig 1. WSN ie wireless sensor network thus helps to reduce the physical efforts to an automatic sytsem. WSN network typically consists of a high number of sensor nodes, also called motes, and of one or few gateway nodes. The gateway node is connected with a computer to access the data of the WSN.

Each mote collects information about its environment using the attached sensors. This information is forwarded to gateway nodes in a multi-hop manner as shown in fig 2.

1.1 Previous System

Fig-1: The Previous Methods for measuring Level and Ph balance

The proposed system mainly consists of three parts:1) data monitoring,2) autonomous monitoring unit and 3) central processing units. The WSN system is thus suitable for the water bodies such as lakes, rivers, dams etc. The system explains the auto-monitoring of the water level and pH value present in an water body. The requirements on a WSN varies very much, because they are used in many different application areas, e.g. precision agriculture, environmental monitoring, structural health monitoring, industrial applications.

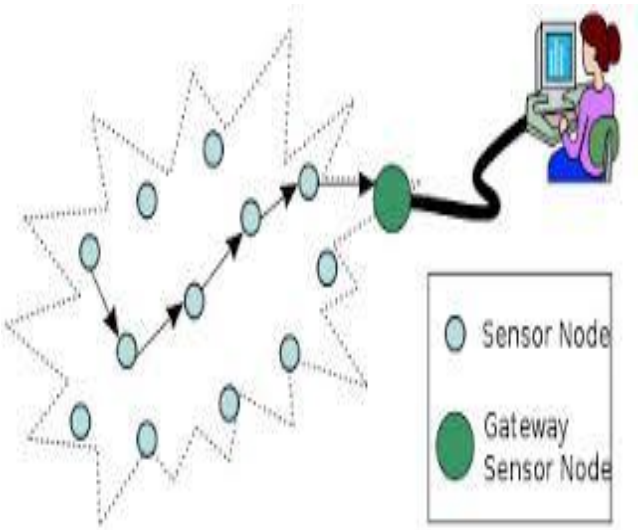


Fig-2: Typical structure of a wireless sensor network.

Usually, it is necessary to preprocess the measured data before it can be transmitted. A microcontroller is used to perform this task. Such a microcontroller provides a wide range of peripherals that are used for measuring the conversion tasks, e.g. analog to-digital converter (ADC), timer and digital IO. This reduces the amount of components needed and also the hardware costs. The main requirement of the system is very low power consumption. The motes are generally powered by batteries or energy harvesting systems (EHS) or both. But Batteries have to be replaced after a certain time , hence, the lifespan of a battery is limited. EHS uses energy harvesting devices (EHDs), e.g. solar cells or thermo generators, to harvest energy from the environment. If the EHS is well designed, it is possible to power the mote continuously. However, both solutions need a low power consumption of the mote. The needed processing power and the maximum allowed power consumption lead to a trade-off between these requirements. However, the specific requirements depend on the application area. The mote should be adapted to that application area.. The pic24FJ64GA002 microcontroller supports all these requirements. There are many different models with different peripherals. It also supports different power modes which can be used to minimize the overall power consumption. This topic shows the development of a mote for river monitoring using a pic24FJ64GA002 microcontroller. The mote is supplied by solar cells and ultra capacitors are used to store the energy for the night. The hardware is adapted to the given application area in order to get the best system performance and to reduce costs.

1.2. The Proposed System

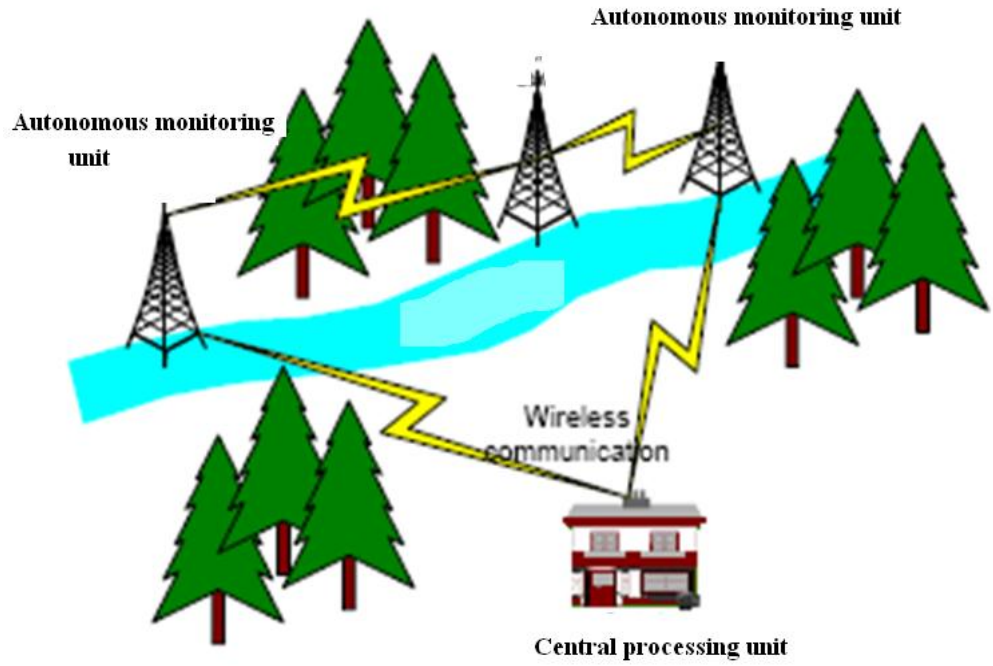


Fig-3: The proposed system

The above fig 3 shows the proposed system of the topic, which consists of different checkpoints where the nodes are situated and the control structure where the control unit is located. The data is transferred from over all the respective nodes denoted as check point and it is monitored and controlled continuously at the control unit. Using this system will eliminate the manual errors and will provide the accurate values at the control unit.

2. THE SYSTEM DESIGN

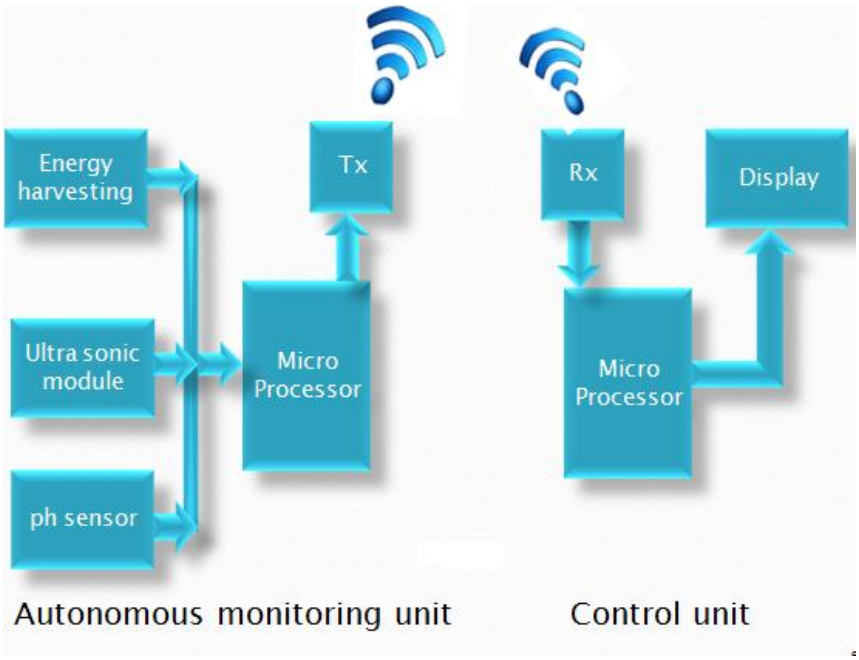


Fig-4: System Block Diagram.

2.1 .Autonomous Monitoring unit

2.1.1 Energy Harvesting System

The energy consumption is done using the Energy Harvesting System. The energy is consumed by using the solar panels, then this energy is stored using the Ultra capacitors. Energy is converted using voltage converter and then this voltage is given as input voltage for the microcontroller.

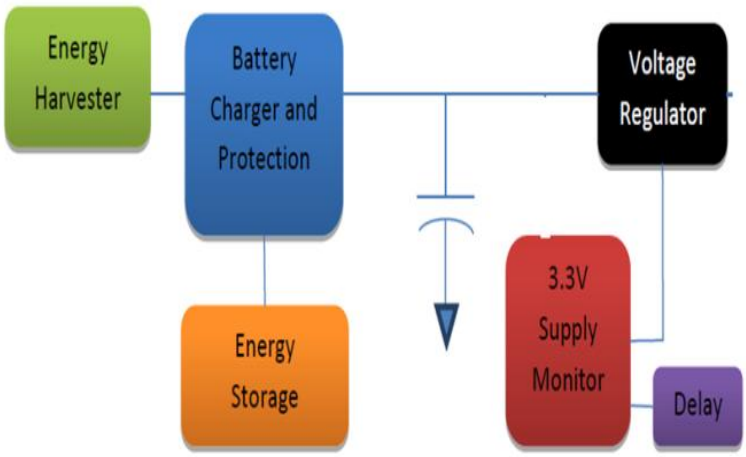


Fig-5: Block Diagram of Energy Harvesting System

2.1.2 Ultrasonic Module

For the water level monitoring Ultrasonic module WL705 are used they transmit waves to the surface under water then this wave strikes the surface and it is then reflected and thus we can calculate the level of water. The result is calculated by measuring the time difference between transmitted wave and the received wave. This information is given to the PIC microcontroller and the data is transmitted to the control unit.

Water Level= Transmitted Wave – Received Wave

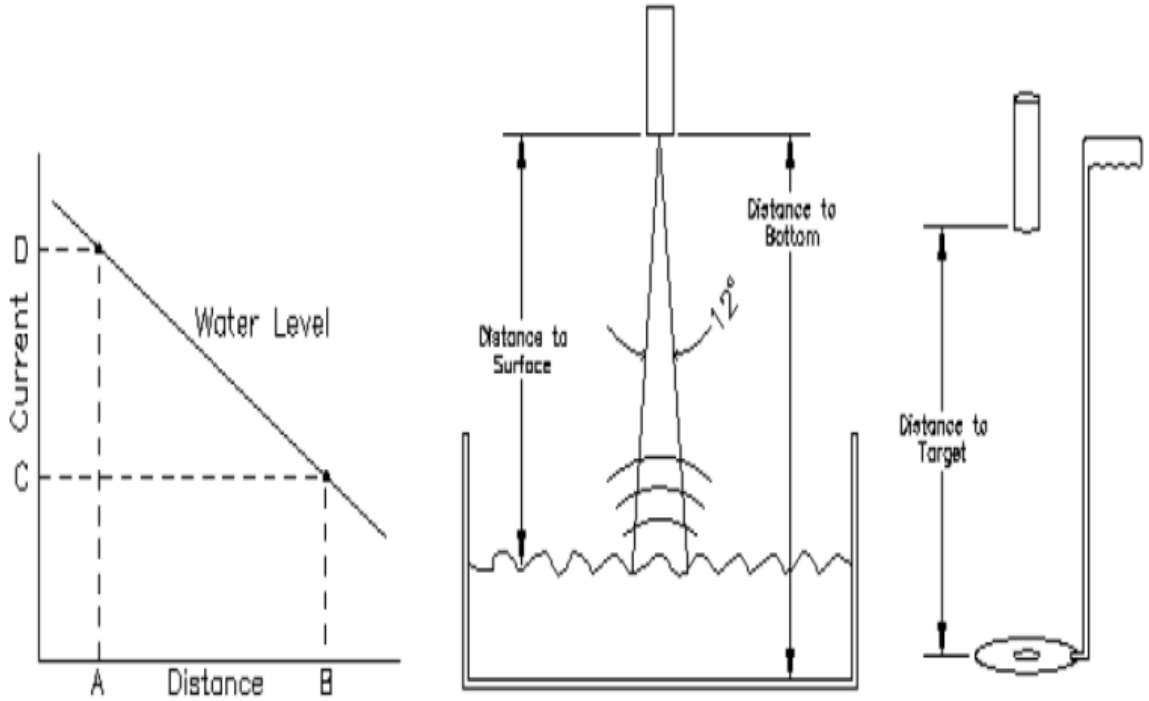


Fig- 6: Mounting of the ultrasonic sensor

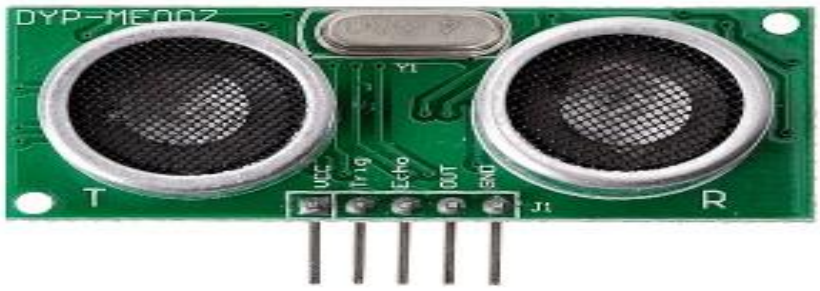


Fig-7: The ultrasonic sensor

2.1.3 Ph Sensor

For checking the water quality pH sensor PHE 45P are used they check the presence of hydrogen moles present in water level and then the pH quality is checked. The information is given to the PIC microcontroller and is then transmitted to the control unit.

The data sensed by the sensors is given to the Microcontroller circuit this data is transformed into the WSN nodes using 2.4GHz 802.15.4 transceiver module.

Fig-8: The Ph sensor

2.2 Control Unit

The data transmitted from the AMU is then received by control unit using 2.4GHz 802.15.4 transceiver module and this data is displayed on PC using VB software in the form of database.At the receiver side we actually get all the data collected by the Water level sensor and the pH sensor at the duration of every 15 min of the microcontroller timer.
Thus the monitoring is done continuously and efficiently.

3. CIRCUITRY OF THE SYSTEM

3.1 Energy Harvesting System circuit Diagram

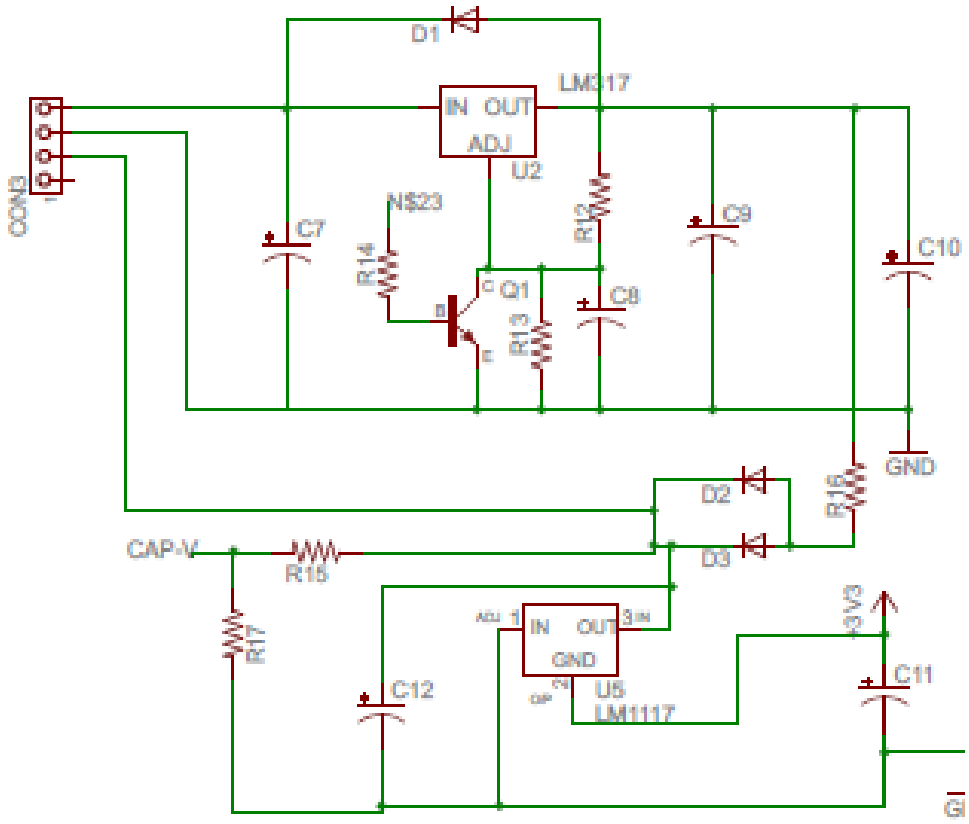


Fig-9: Circuit Diagram of the EHS.

3.2 Zigbee Module Connection

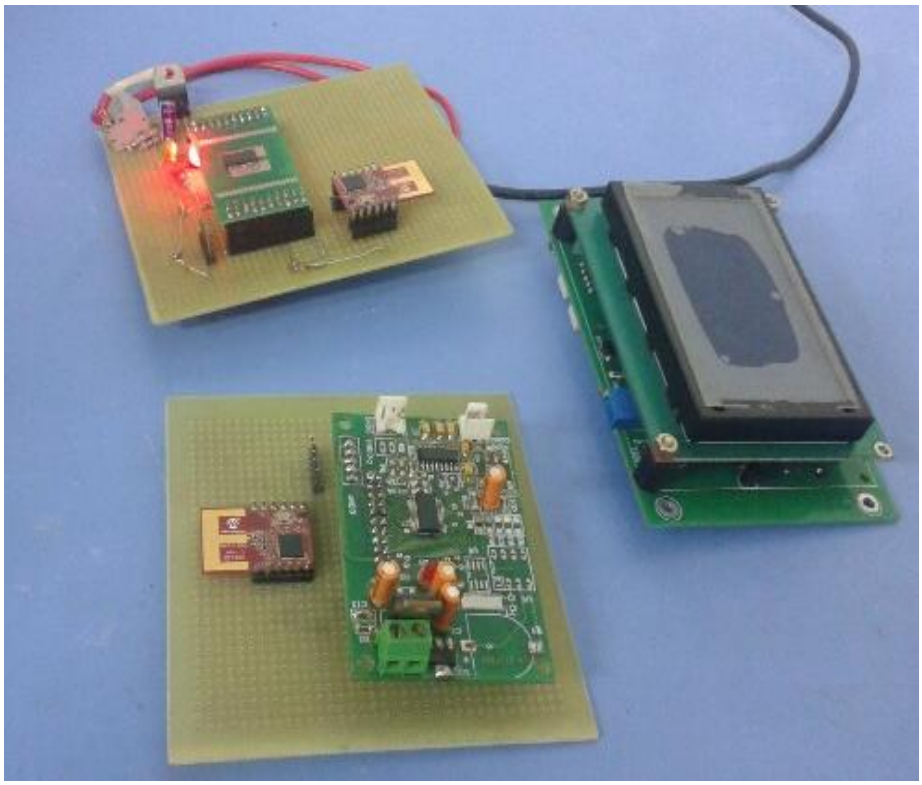


Fig-10: Circuit Diagram of the zigbee Module.

3.3 Main Circuit

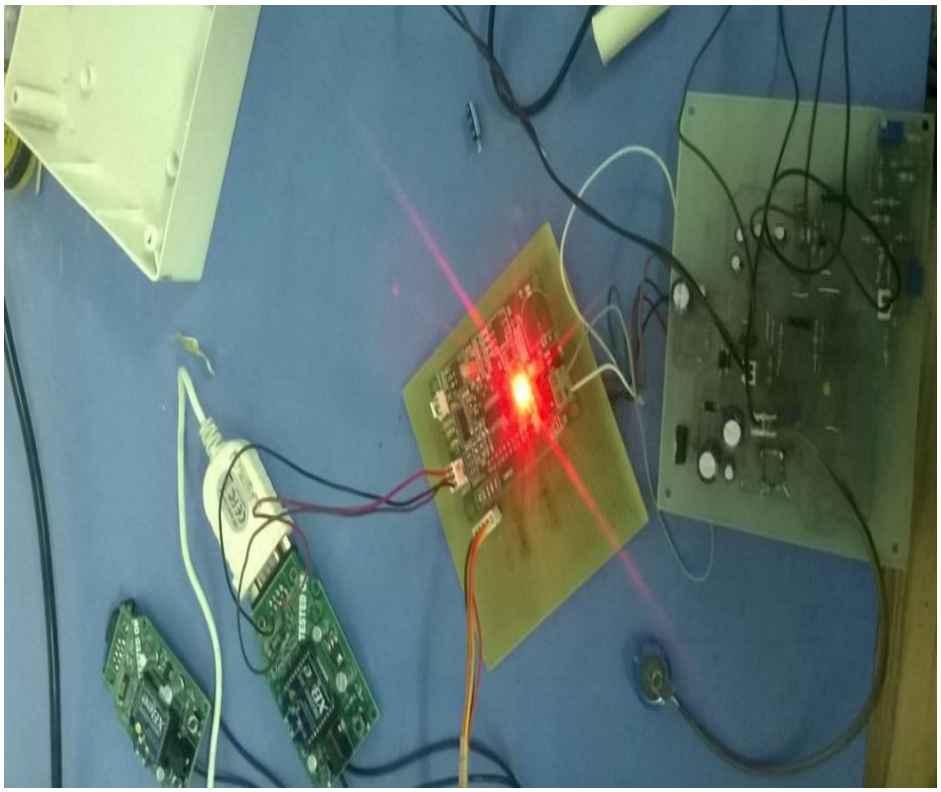


Fig-11: Diagram of Hardware Connection

4. EXPEREMENTATION RESULT

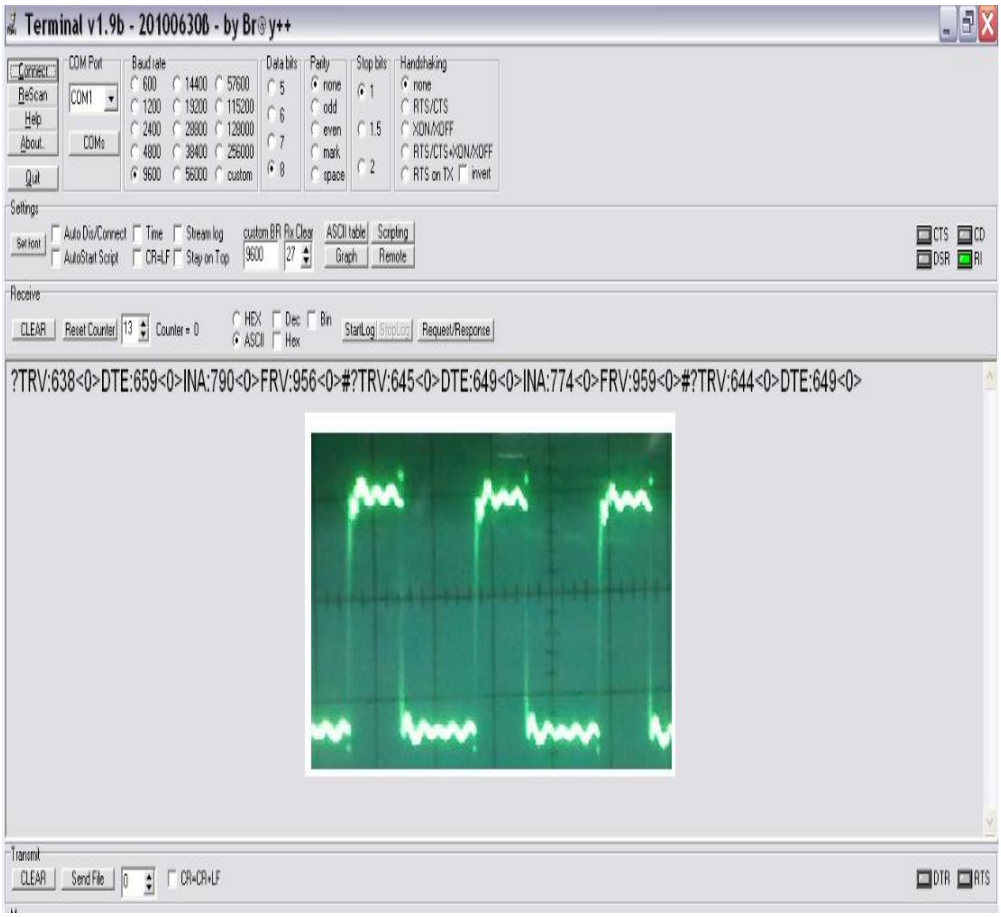
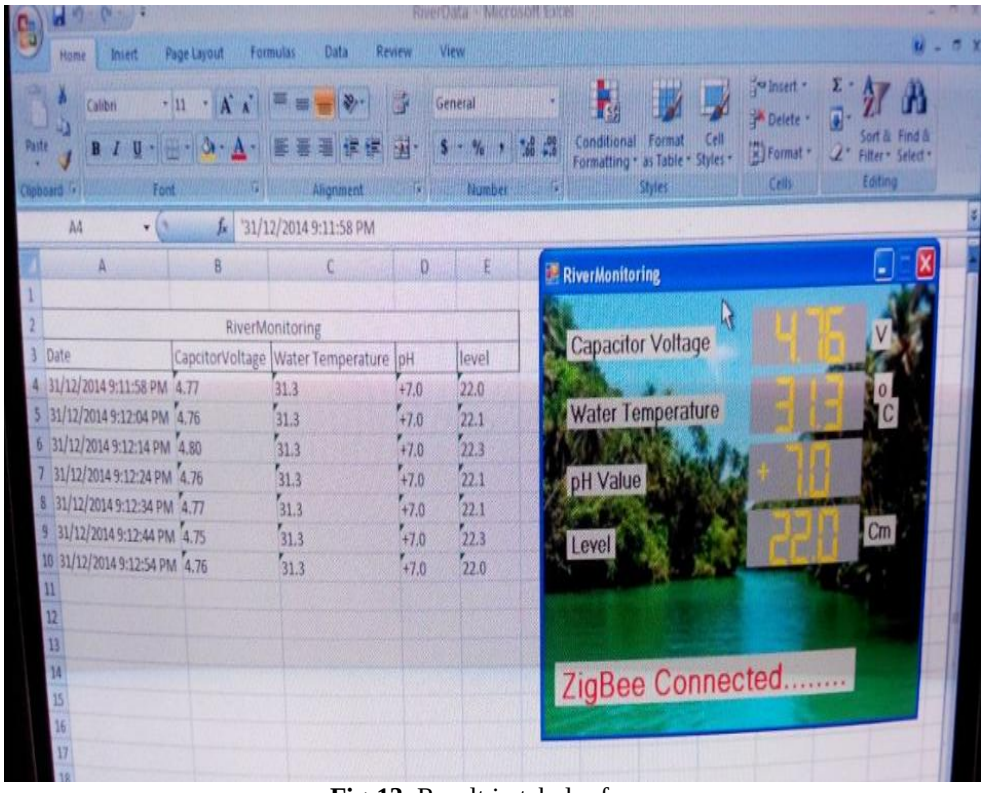


Fig-12: Result of the ultrasonic module



Date	CapcitorVoltage	Water Temperature	pH	level
31/12/2014 9:11:58 PM	4.77	31.3	+7.0	22.0
31/12/2014 9:12:04 PM	4.76	31.3	+7.0	22.1
31/12/2014 9:12:14 PM	4.80	31.3	+7.0	22.3
31/12/2014 9:12:24 PM	4.76	31.3	+7.0	22.1
31/12/2014 9:12:34 PM	4.77	31.3	+7.0	22.1
31/12/2014 9:12:44 PM	4.75	31.3	+7.0	22.3
31/12/2014 9:12:54 PM	4.76	31.3	+7.0	22.0

Fig-13: Result in tabular form

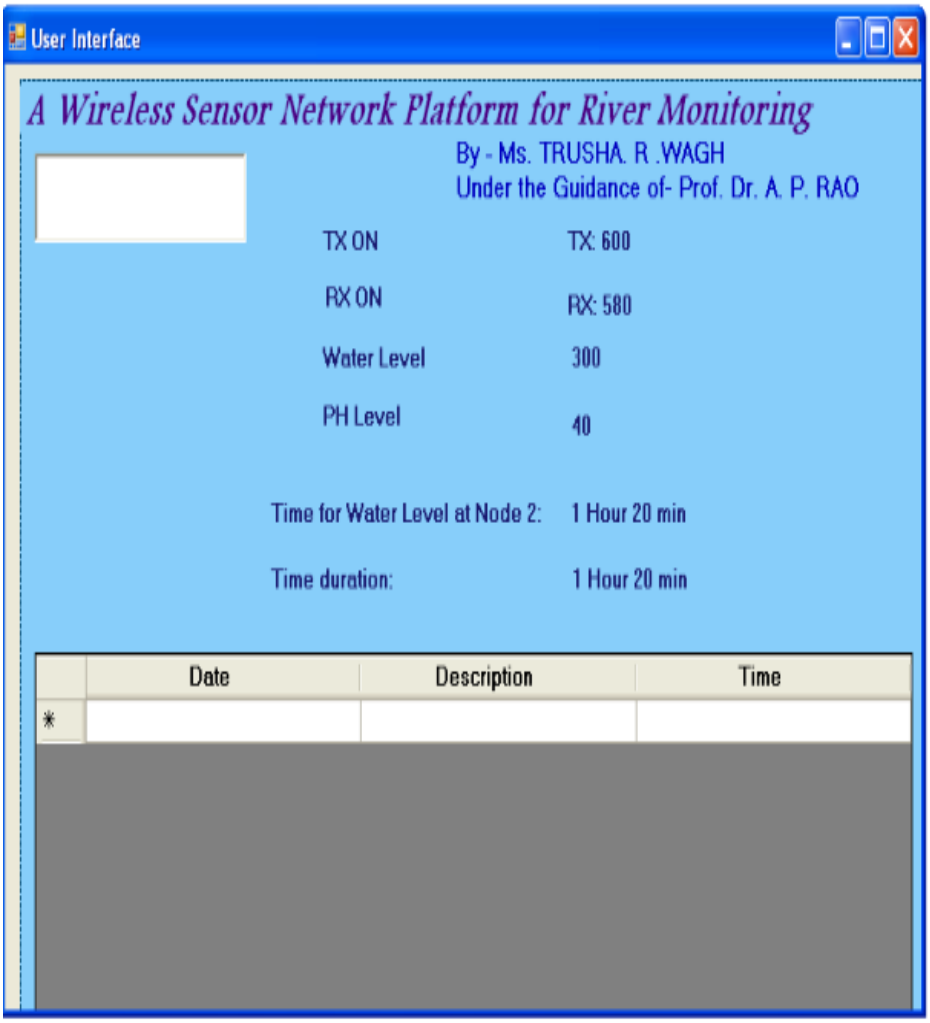


Fig-14: Result of the GUI output

5. CONCLUSION

This work demonstrates the adaptability of a mote to a specific application area using the microcontroller. It shows low power design techniques. It also demonstrates the possibility to supply the mote continuously using an energy harvesting system and battery as the energy storage elements. This system uses MRF24FJ40MB which uses the MAC protocol. This system is not limited only for River monitoring , it can be build on Dams as well to check the water level. We can thus define the accurate results of pH balance and water level using this system.

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BIOGRAPHIES

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