

Design of WSN for Environmental Monitoring Using IoT Application

Sarika Shinde¹, Prof. Venkat N. Ghodke²

P.G. Student, Department of E and TC Engineering, DPCOE Engineering College, Pune, Maharashtra, India¹

Assistant Professor, Department of E and TC Engineering, AISSMS College, Pune Maharashtra, India²

ABSTRACT: IoT provides a networked interconnection to the everyday objects which is usually connected with ubiquitous intelligent. Any place can control from a distance using IoT by accessing remote sensor data. WSN is most beneficial for long term data acquisition for IoT applications. Basically Environmental monitoring for IoT is to control the sensed data through ARM processor and transmission of data safely using RF. This system also uses GSM technology for secured and global communication. The proposed system can be applied to many applications like green house, agriculture; industrial waste monitoring or location can be anything we may be interested in. The system is designed considering easy deployment, low cost, low power, system quality, long life and safe communication.

KEYWORDS: IoT, GSM, RFID, Wireless Sensor Network, Sensor Nodes, WAMP Server.

I. INTRODUCTION

Now a days, technology used in industries, household, or it may be daily changes in environment is all about wireless control and automation. Any physical system can be controlled easily by using wireless technology compared to manual operation. [4] If this automation is considered for environmental monitoring, it responds very fast. Also it increases chances of secure communication, speed of the system operation.

The monitoring systems used in previous days need a human support for operation, so there can be chances of human errors. WSN i.e. wireless sensor network which helps in reducing physical efforts to the automated systems. WSN consist of number of sensor nodes and gateway node. The system can be called as a smart system which can measure parameters automatically. Sudden or gradual changes in environment are occurring because of human careless behaviour about environment. This results in disasters which can cause harms to human lives. The system can intimate in advance to user about such causalities.

This system uses GSM network for the wireless control of environmental parameters. In this project, application of GSM network to indicate the status of each sensor connected to the controller. Many applications and limitations of this monitoring system are discussed briefly.

II. STRUCTURE OF WSN PLATFORM

The proposed system mainly consists of three parts : 1) Sensor node 2) WAMP server and 3) Monitoring devices .The tiered structure of WSN platform is shown in figure.

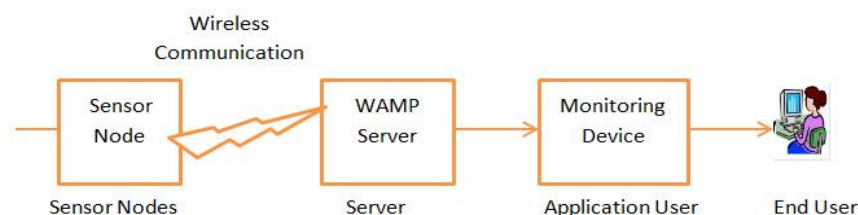


Fig. 1 Tiered structure of WSN

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 7, July 2016

A sensor network is composed of number of sensor nodes,[8] User can spread wide variety of sensors within the interested area to monitor all collected data by extending period of time which can enable researcher to study if there is any complex interactions within the environment.[11] For good application performance sensor node's specifications is important. Sensor node physical size, cost reduction, weight and long maintenance free service time are also important requirements.[1] WAMP server is a software stack for windows operating system .It is used as database and it collects, process and forward the information received from RF receiver to the server which is connected to the server . PHP is the part of WAMP server and is used to access the data from database. Backend alerts means end users processes this stored data using internet.

III. BLOCK DIAGRAM

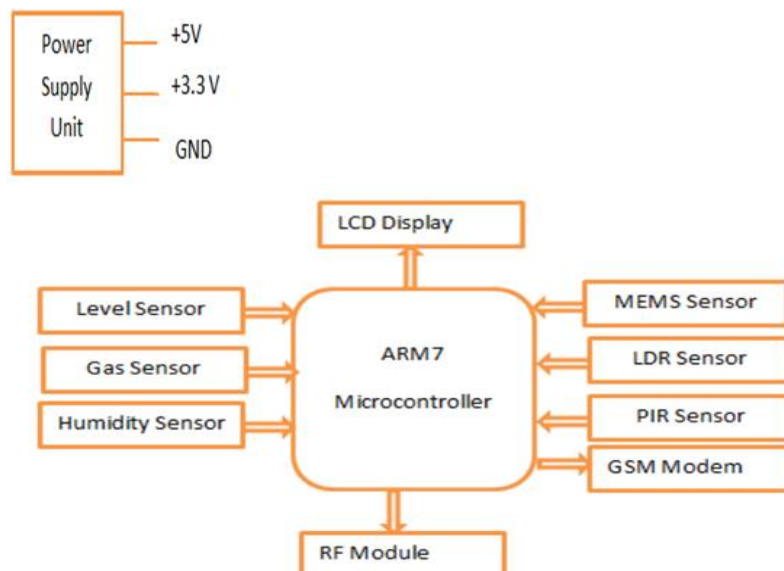


Fig. 2 Block diagram of Transmitter with GSM Modem and Power Unit

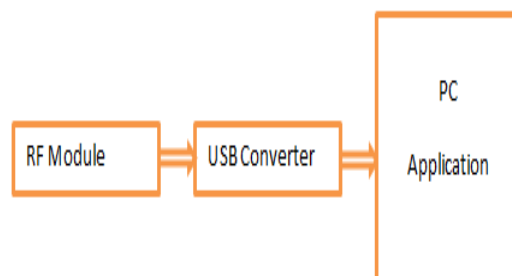


Fig. 3 Block diagram of receiver

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 7, July 2016

IV. BLOCK DIAGRAM DESCRIPTION

The block diagram is divided into following modules:

1. LPC 2138 Microcontroller: The NXP (Philips) LPC 2138 is an ARM7TDMI-S based 32 bit RISC microcontroller. [2] LPC 2138 processor is used in proposed system to monitor process and control the process. LPC 2138 saves up to 33% less power than other microcontrollers. All the sensors are interfaced to LPC 2138 which is heart of the system. On chip ADC [6] improves the performance of LPC 2138. PIR & LDR sensors are digital sensors & rests of others are analog sensors.

2. Sensor module: Sensors module consists of six types of sensors. These sensors collect information about status of environmental parameters and feed it to controller. Function of sensors is given here.

- Level sensor: If water crosses to the danger level in dam, tank or reservoirs, level sensor will check water level & it will processes signal accordingly. Level sensor is Float sensor type. It operates automatically when liquid or water level goes up or down w.r.t. its specified level. Thus the Signal available from the float Sensor can be used for controlling of a Motor Pump or allied electrical elements.

- Gas sensor: Gas sensors are designed to detect and measure CO₂ level and give intimation of dangerous level mixed in the environment to end user. MQ7 gas sensor is used to sense the gas. As CO₂ is detected it will give intimation of gas detected. Output is given to ADC pin of ARM 7.

- Humidity sensor: SY-HS-220 sensor is used to check the water vapour contained in the air or environment. Like other analog sensors it also gives output in the form of humidity if humidity is there in environment. Output is connected to the analog pin of processor.

- MEMs sensor: Micro-electro-mechanical systems sensor is used to measure shocks, dynamic acceleration, vibration and static acceleration (tilt or gravity). ADXL 335 with 3 axis sensing, low power is preferred. It can survive at 10000 g shocks.

- LDR sensor: Light Dependent Resistor (LDR) is used to detect light intensity. It helps in maintaining light intensity required for environment like in green houses.

- PIR sensor: Pyro electric infrared module sensor allows users to sense motion, mostly used to detect whether human or animal body has moved in the sensor range. Module provides an optimized circuit that will detect moving animal up to 6 meters away.

It is inexpensive, small in size, easy to use. [3] When human body is detected output of PIR sensor goes high.

3. GSM Modem: SIM 900 [7] GSM Modem is used to communicate over longer distances & to alert authorities via SMS on mobile. GSM (Global system monitoring) system & RF Module uses serial communication UART devices i.e. UART0 & UART1. The system uses a wireless communication through GSM network.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 7, July 2016

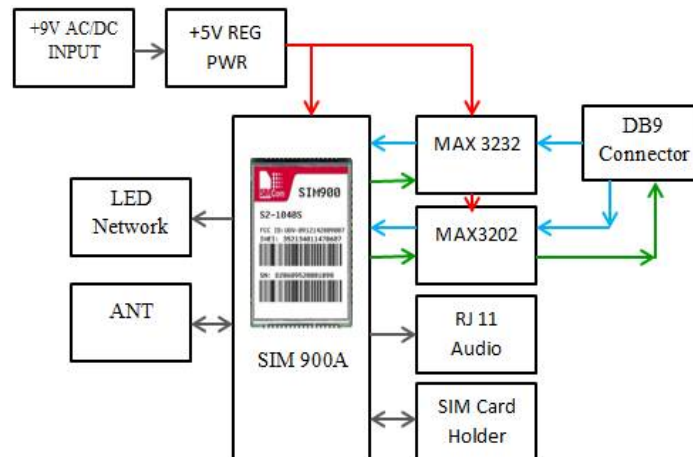


Fig. 4 General block diagram of GSM module

Now a day, every person has a mobile phone with him and GSM network makes it possible for people to communicate with each other. So in this project a device based on the GSM network to control environmental parameters through cellular phones is designed. [4] The system includes cell phone which is connected to the designed system via SIM Card holder. If there is any message regarding parameter change, the system sends a message to cell phone of user from the SIM Card inserted in GSM module.

GSM module SIM 900 is used in this project. It works like a cell phone and offers a facility of sending message to user phone. This communication of sending messages is programmed by using AT commands. The basic AT commands which are necessary are used in programming of microcontroller. Figure shows GSM modem having signal pins connected to the communication port includes: RJ 11 audio, SIM card holder, antenna, LED network, transmitter and receiver pins, external power pins, flash programming signal pins. Tx and Rx pins are used for the serial communication with controller. Various AT commands are there to check SIM card connection and signal range. Some basic commands for GSM are used in the program of controller to connect with the GSM module.



Fig. 5 SIM 900 GSM Modem

4. RF Module: Wireless Serial Communication RF Module, 2.4 Ghz, 30 m range (Wireless UART @9600) is used. RF tx module receives data collected by microcontroller. It transmits received data to RF rx module and RF module

International Journal of Innovative Research in Science, Engineering and Technology

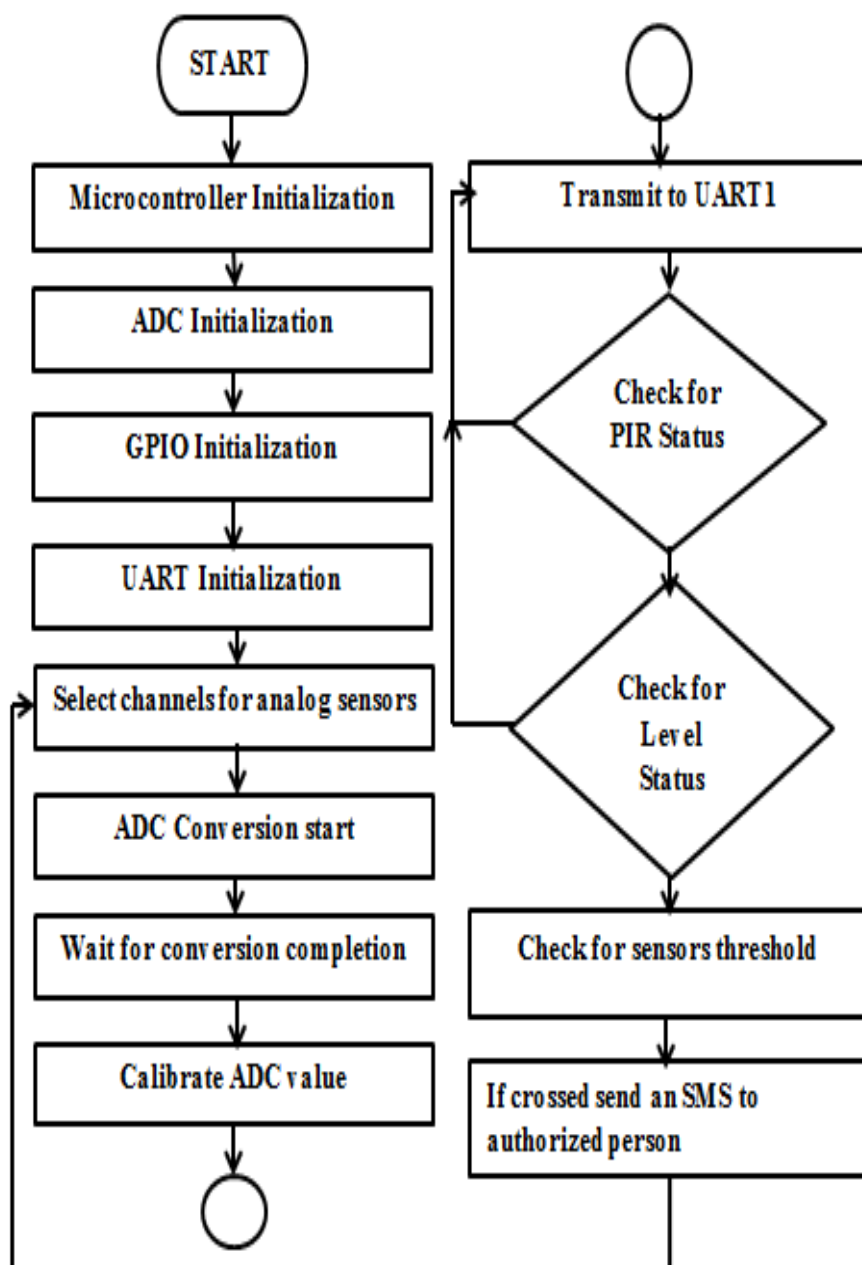
(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 7, July 2016

transmits this received data to end user through USB converter. It has 30 meters range with onboard antenna. [5]
Typically, this trans-receiver is used with a microcontroller.

5. PC Application: JAWA is used as PC application. WAMP server tool is used to store received data in its database from RF receiver.

V. FLOWCHART FOR THE SYSTEM



International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 7, July 2016

VI. EXPERIMENTAL RESULTS

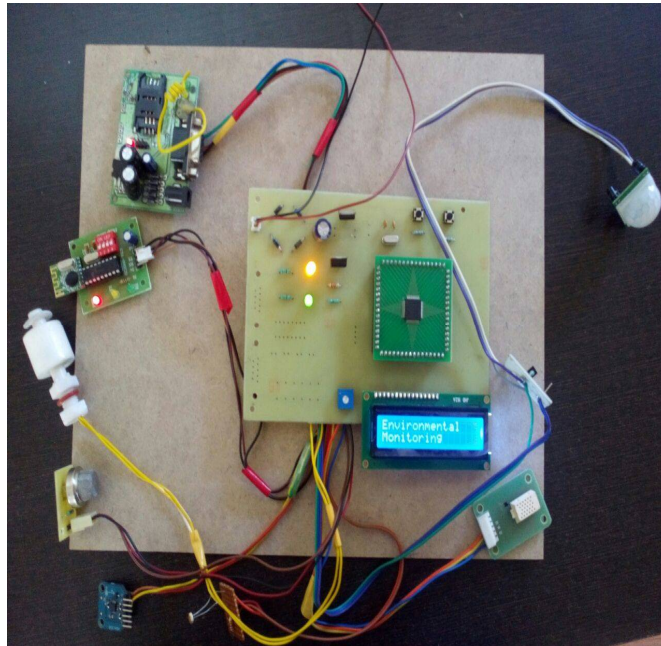


Fig. 6 Experimental setup for the system

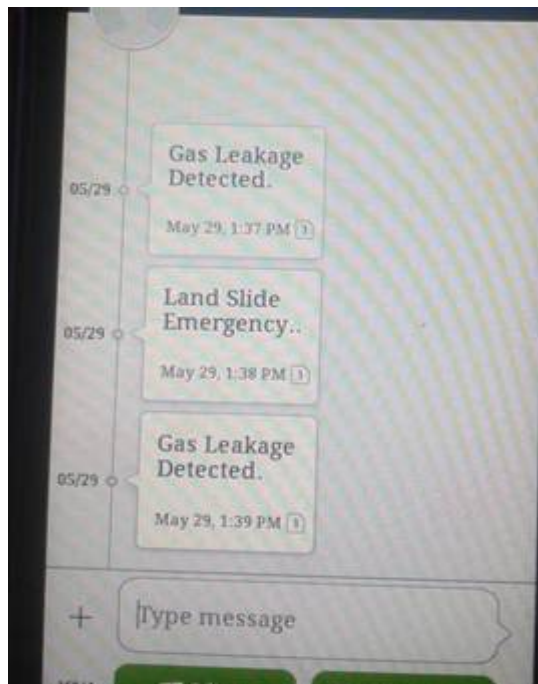


Fig. 7 Output of GSM on Mobile Phone

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 7, July 2016

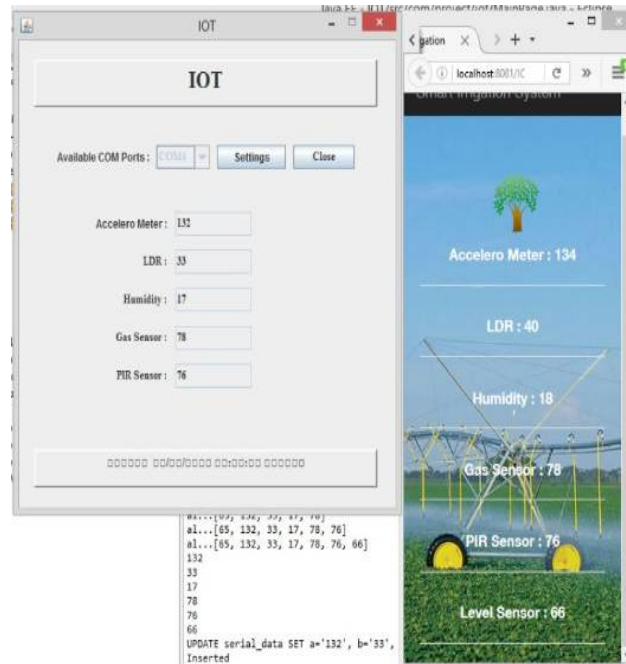


Fig 8 Result in tabular form using JAVA application on PC

VII. CONCLUSION

Wireless Sensor Network is designed successfully and implemented for the purpose for which it has been designed. On observation of the performance it is concluded that the present system is reliable and variety of applications can be applied. Application parameters calculation and monitoring is precise and automatic even over the larger area. System can be monitor globally using uploaded data over internet. GSM is an alternative secure way to the internet. Parameters threshold can be changed depending upon the environment

REFERENCES

- [1] Mihai T. Lazarescu, "Design of a WSN platform for long-term environmental monitoring for IoT applications," Emerging and Selected Topics in Circuits and Systems, IEEE Journal on, Vol.3, Issue.1 pp.45-54, 2013
- [2] Datasheets of LPC 2138, www.nxp.com.
- [3] Datasheets of PIR sensor, www.instructables.com/id/PIR-Motion-Sensor-Tutorial
- [4] Vasumsetty Uday Aditya, "GSM based wireless control of electrical appliances", 2014
- [5] Datasheets of RF Transceiver 2.4 Ghz, www.sunrom.com.
- [6] J. Peng, X. Hongbo and W. Zheming, "Design of a Water Environment Monitoring System Based on Wireless Sensor Networks", *SENSOR* vol.9, No.8, pp: 6411-6434, 2009.
- [7] Datasheets of GSM SIM900, XM1510S Quick Start Manual.
- [8] I. F. Akyildiz, W. Su, Y. Sankarasubramanian and E. Cayirci, "Wireless Sensor Networks: a survey", *Computer Networks*, vol.38, pp: 393-422, 2002.
- [9] J. Yang and X. Li, "Design and implementation of low-power wireless sensor networks for environmental monitoring," *Wireless Commun., Netw. Inf. Security*, pp. 593-597, Jun. 2010.
- [10] M. Anisi, A. Abdullah and S. Razak, "Energy-Efficient Data Collection in Wireless Sensor Networks," *Wireless Sensor Network*, Vol. 3 No. 10, 20
- [11] Pascal Von Rickenbach, "Energy-Efficient Data Gathering in Sensor Networks".