ISSN: 2277-9655
Impact Factor: 1.852

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

# Environmental Data Monitoring Using Wireless Sensor Network and Transmission of Data Via Internet

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## Abstract

The objective of this paper is to effective monitoring of environment by using Wireless Sensor Network (WSN) and the collection of data will be transmitted through the server through Internet. Before that it was done manually which is not accurate and also the immediate updation of information is not so easy. In our proposed system by using wireless sensor network data gathering is easy since WSN technology is used. By incorporating various sensors for sensing different parameters and by placing those sensors at different locations this can be achieved .Two major sensors such as river flood detection sensor for monitoring of water level variation in rivers and UV-ray detection sensor for the radiation measurement of the field. The detected level of variation will be processed and transfer through server. Both the sensor measures the level of variation and if it exceeds the threshold level the information will be transfer through internet as well as alert through mobile and also gives alarm to the nearby field areas. It may provide good security for all the living being during the period of disaster.

**Keywords**: Internet, flood detection sensor, uvrays detection sensor, zigbee transmitter and receiver, controller ,GSM.

## Introduction

The main objective is to sense the intensity of the harmful UV rays and Flood detection from a remote area through wireless sensor network. The wireless sensor monitors the UV ray intensity and the data is transferred to server via Zigbee protocol. The combination of CC2500 Zigbee module and Atmega16 controller forms the wireless sensor network.The curiosity of mankind for the natural environment and the environmental phenomena was the driving force that led him search and learn things that today are given for us. Thanks to this characteristic, of todays, we have the knowledge of various phenomena, thus giving us the opportunity, through detailed monitoring, to predict events and to prevent these of happening. In the past, various physical parameters were measured by some analog mechanisms which at that time was very innovative, however it is too costly and not very efficient. In the last century the use of digital data loggers replaced the previous technology, being less expensive and more easy to use but still not efficient. Recent technological advances led to the development of very small sensor devices with computational, data storage and communicational capabilities. These devices which called wireless sensor nodes, when are deployed in an area (indoors or outdoors) form a Wireless Sensor Network (WSN).

The initial development of WSN was motivated by military applications such a detection ,battlefield surveillance,etc.now a day's WSN was used in many other fields, like agriculture ,environmental monitoring oceans,volcanoes,forests,health monitoring, structural monitoring and more.wsn is a promising tool of monitoring events. In the particular thesis, the issue under research is wsn in environmental monitoring,in which case the wireless sensor network is called environment sensor network(ESN).ESN can be categorize broadly into two type of monitoring that is ,indoor and outdoor .Indoor monitoring include building and offices. Outdoor monitoring refers to habitat monitoring, flooding-landslide-earthquake detection, traffic monitoring and other. Another categorization, referred to their behavior, could be into reactive wsn means that the sensor nodes Means the sensor nodes, for measuring and sending the predetermined with respect to parameters. The major contribution is being proposed to estimate accurate

ISSN: 2277-9655
Impact Factor: 1.852

and efficient monitoring of uvrays detection and flood detection by using wireless sensor network.

## Related Work

WSN environmental monitoring measures both indoor and outdoor applications. The section include of many category (like pollution monitoring) on open nature the outdoor deployment can be difficult for extreme climate weather condition but it is difficult for maintenances and too costly. By considering in the open nature it is very easy for monitoring and it gives low cost and low maintenance for the design.

To be cost-effective ,the sensors to operate on restricted energy reserver.permature energy depletion can be limited the service of network[3].The important for monitoring many application of climatic condition ,such us glaciers,permafrosts and others[7 ],[3 ]. Open nature deployments [2]–[14] and communication protocol developments and experiments [4], [8] show that WSN optimization for reliable operation is time-consuming and costly. It hardly satisfies the IoT applications requirements for long-term, low-cost and reliable service, unless reusable hardware and software platforms [4]–[15]] are available, including flexible Internet-enabled servers [5]–[13] to collect and process the field data for IoT applications.

## Methodology

The idea behind this project was to detect real WSN deployments that have been developed and study them to make a categorization based on components used in every deployment. These components include general information about the deployment such as place of deployment, duration, area size, etc. Hardware parts such as node platform and its components, which are microcontroller, radio transceiver, memory size and type, types of sensors, number of sensors, installation and other issues. Regarding to software, the categorized was made based on protocols and algorithms used in every case and the operating system implemented in the sensor nodes. Network issues include the means of communication that consisting of wireless, wired, satellite connection or cellular network. Also, the sensing of the measured parameters is classified into time -based, event-driven and Requirement-based WSN as well as single hop or multi hop communication. The power management and supply is classified according to battery type, estimated lifetime, replacement issues and capacity as well as external power supply used for unattended WSN function and power saving and management techniques. Last but not least are the cost and maintenance issues regarding to WSN deployments.

## Wireless Sensor Network

A WSN is, traditionally, consisting of a few to dozens and in some cases thousands of sensor nodes, connected to one or more sensors. It also includes a base station (BS) which acts as gateway between the wsn and the end users. Each sensor node is consisting of the five main components, which are a microcontroller unit ,a transceiver unit, a memory unit and a sensor unit. Each one of these component is determinant in designing a wsn for deployment. The microcontroller unit is in charge of the different tasks, data processing and the control of the other components in the node. Through the transceiver unit a sensor node platform its communication with other nodes and other parts of the WSN. It's is the power consumption unit. The memory unit is for temporal storage of the sensed data and can be RAM,ROM and the other Memory types, flash even external storage device such as USB. power unit, which is one of the critical components, is for node energy supply. power can be stored in batteries rechargeable or not or in capacitors. For extra power supply and recharge,there can be used natural sources such as solar power in form of photovoltaic panel and cells,wind power with turbines ,kinetic energy from water,etc.Last but not least is the sensor unit,which includes bone or more different types of the sensors for parameter measures temperature, humidity.

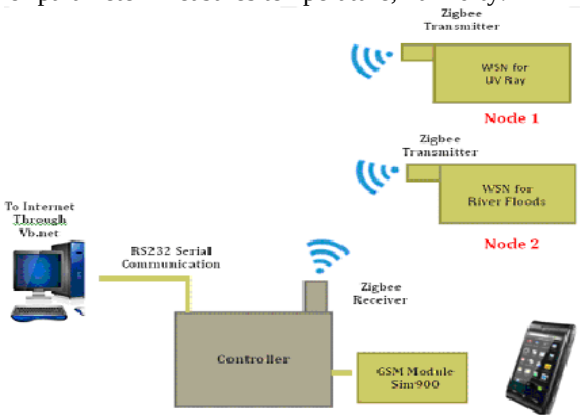


**Figure 1: Block diagram**

### Wsn Node Design

In this section will be presented the different sensor used and its measurement of the parameter over different location,and analysis the possible solution for the design.

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**Sensor Node Design**

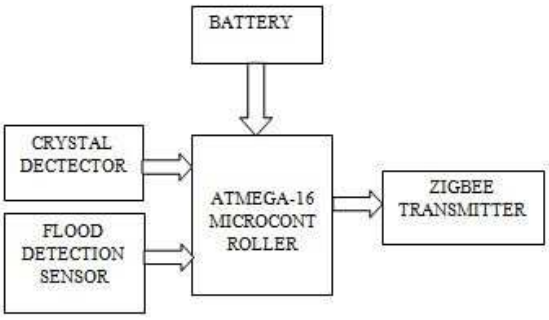


**Figure 2: River Flood Detection System**

In most of the cases, floods are provoked by external acts so forecasting them and knowing the flooding areas becomes critical to minimize the damages. On the other hand, the water becomes an increasing scarcly to the resources, heavy flood events not provided an opportunity to divert water into more productive uses during times of heavy rainfall. The challenge of predicting floods has been addressed with manual reads or satellites, and these methods are not always possible nor even the best choice. In the form of manual readings, it implies someone seeing a physical sign of water level close to the river, in which is not scalable for measuring the long rivers of kilometric more people affected by natural disasters lives available data from satellites comes in lengths and may put the person herself into the danger. In the case of satellites, they get advantage of its ubiquity to provide input data for flood forecasts. However in the case of developing countries – where wide time intervals and may be insufficient. Wireless sensor networks are a cost-effective and scalable alternative for detecting early flood condition, forecasting floods, and monitoring flooding areas. Motes can be spreader along the course of a river to measure increased water levels and generate alerts wirelessly by SMS or Internet database posting.

The network can also be used to monitor weather conditions and rainfall, makes easier and accurate the forecasting floods, and determining of flooding in areas close to the coast, river, etc. Wasp mote can monitor these parameters using the events sensor board **(**water level**) .** The nodes can be placed on top of pylons and recharge their batteries with solar panels. Covering large distances is also an issue in this scenario since the goal is to monitor coast areas or river courses. Wasp mote gets outstanding radio links in the frequency bands of 2.4 GHz, 900 MHz and 868 MHz using the Zigbee protocols.

**Water level sensor**

Level sensors detect the level of substances which flow, including the liquids. Fluids and fluid solids flow to become essentially level in their containers because of gravity whereas most bulk solids pile at an angle to a peak. The substance can be measured inside a container or can be in its natural form (e.g., a river or a lake). The level measurement can be either continuous or point level. following level sensors measure level with in a particular range and determine the exact amount of material in a certain place, while point level sensors indicates whether the substance is above or below the sensing level. Generally the detect levels that are excessively high or low.

**UVRAYS Detection Sensor**

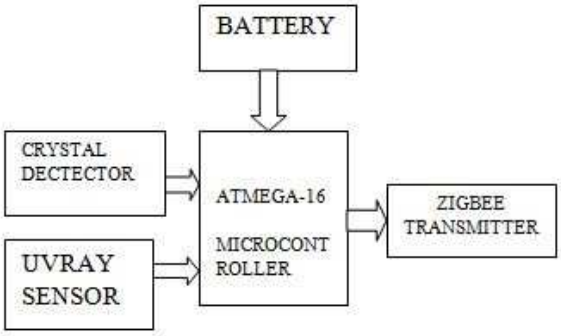


**Figure 3:UV-RAY measurement system**

The amount of UV light reaching the ground in any given place depends on a number of level, including the particular day, year, elevation, and others. The people to understand the intensity of UV light in their area to that day, the National Weather Service and the Environmental Protection Agency (EPA) have developed the UV Index. The UV Index to measure, on a scale from 1 to 11+, is a measure of the strength of the UV rays reaching the ground during the noon. The large numbers which exposure the UV rays, and the higher the chance of sunburn and skin damage. The feature of the UVI-01 is able to detect the UVA and UVB band ,and direct output of UVI,(Ultraviolet INDEX),The UVI-01 is very suitable for the field of UV measurements. As the communications are doing wiressly using the zigbee and GPRS protocols the information can be transmitted at any local or central point where can be process and stored the results and generating alarms when the values are in the High or Very High level in the UV Index.

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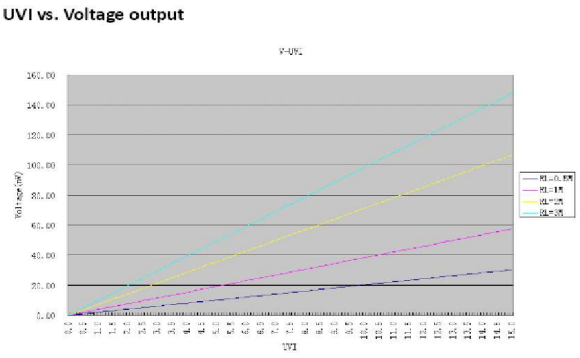


**Figure 4: Voltage output**

the number of photons that reach the surface of the sensor each per second, it also necessary to know the exact distribution of the radiation along the spectrum. This means by knowing in detail which intensity of radiation corresponds to the frequency, since the energy transmitted to a photon is a function of the frequency associated to it. The electro-optical characteristics are following in the table.

| parameter | Condition | min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Spectral wavelength range | - | 290 | - | 400 | Nm |
| The most sensitivity wavelength | - | - | 330 | - | Nm |
| Output voltage | Ee=100nw/m2 | - | 0 | 0.2 | Mv |
| sensitivity | RL=1Mohm | 3.9 | 4.0 | 4.1 | mV/UVI |
| inaccuracy | | | | 15 | % |
| Reverse break down voltage | - | 30 | 40 | 100 | V |
| Capacity | f=MHZ | - | 6 | - | pF |

**Figure 5:Electto-opticalcharacteristic**

Cancers.UVB rays can directly damages DNA, and are the main rays that cause sunburns. They also thought to cause the most skin cancers.UVC rays don't get through the atmosphere and therefore it is not in the sunlight. They cannot normally causes of skin cancer. Skin cancers are one result of getting too much of sun, but there are other effects as well. Ultraviolet (UV) radiation is a risk factor for most skin cancers. Sunlight is the important source of UV rays, which can damage the DNA in the skin cells. Tanning lamp and beds are also sources of UV rays. People whom to get a lot of exposure to light from these sources are at greater risk for skin cancer. UVA and UVB rays make up only a very small portion of the sun's rays, but they are the main cause of the sun's damage the effects on the UVB rays are a more potent to cause of at least some skin cancers .

The amount of UV exposure a person gets depends.UVA rays age cells and can damage cells.DNA. They are linked to long-term skin damage such as wrinkles, but are also thought to play a role in some skin cancer.UVB rays can directly damages the DNA, and are the rays that cause sunburns. They are also thought to cause most skin cancers.UVC rays don't get through our atmosphere and therefore are not in sunlight. They does not normally cause of skin cancer. Skin cancers are result of getting too much sun, but they are the other effects as well. Sunburn and tanning are the short-term results of too much exposure of UV rays, and are rises of skin damage. Long-term exposure can cause prematurely aged skin, wrinkles, loss of skin elasticity. The

The sensor outputs a voltage proportional to the energy receive

amount of UV light reaches the ground in any given place depends on a number of factors, including the day, time of year, elevation, and cloud cover. To help people better understand the intensity of UV light in their area for a given day, the National Weather Service and the Environmental Protection Agency (EPA) have been developed for the UV Index. The UV Index level, on a scale from 1 to 11+ is a measure the strength of the UV rays reaching the ground during an noon time. The higher the number, that greater the exposure to UV rays, and the higher the chance of sunburn and skin damage that could ultimately lead to skin cancer.

**Receiver section**

The receiver section which has the following Component that receive the data through the Receiver to microcontroller and battery for maintenance of power supply ,GSM module for the transmission of information through the mobile and also by using RS232 the date will be transfer through the server as internet.

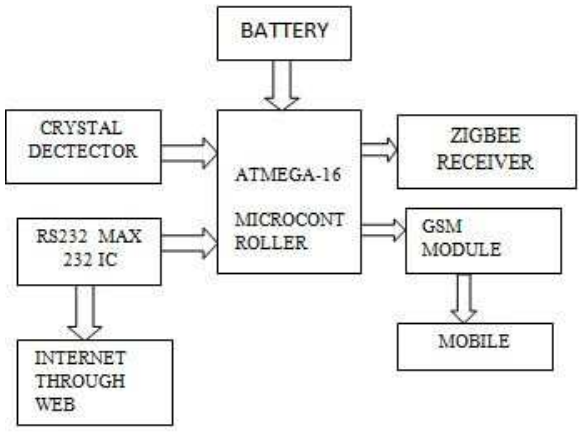


**Figure 6:Receiver section**

**Device Implementation**

Software Used:

- AVR Studio 6
- ISIS Professional release 7.7

**Isis Professional Release**

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Proteus is software of microprocessor simulation, schematic capture, and printed circuit board (PCB) design. It is developed by Lab center Electronics.

**System Components**

- ISIS Schematic Capture - a tool for entering designs.
- PROSPICE Mixed mode SPICE simulation - industry standard SPICE3F5 simulator combined with a digital simulator.
- ARES PCB Layout - PCB design system with automatic component placer, rip-up and retry auto-router and interactive design rule checking.
- VSM - Virtual System Modeling lets co simulate embedded software for popular micro-controllers alongside hardware design.

**AVR studio**

Atmel® Studio 6 is the integrated development platform (IDP) for developing and debugging Atmel ARM® Cortex™-M and Atmel AVR® microcontroller- (MCU-) based applications. The Atmel Studio 6 IDP gives seamless and easy-to-use environment to write, build and debug applications written in C/C++ or assembly code.

- Atmel Studio 6 is free of charge and is integrated with the Atmel Software Framework (ASF)—a large library of free source code with 1,600 ARM and AVR project examples. ASF strengthens the IDP by providing, in the same environment, access to ready-to-use code that minimizes much of the low-level design required for projects. Use the IDP for wide variety of AVR and ARM Cortex-M processor-based MCUs, including broadened portfolio of Atmel SAM3 ARM Cortex-M3 and M4 Flash devices.

The Atmel Studio 6 IDP also:

- Facilitates that reuse of existing software and, by doing so, enables design differentiation.
- Supports the product for development process to be easy access to integrated tools and software extensions through Atmel Gallery.

## Result

The implementation of uvrays detection node, reservoir flood detection node by using software AVR Studio 6,ISIS Professional release 7.7.The program is build using AVR studio. AVR studio is compiler software in which c program is build and compiled. This compiler software produces hex file as an output. This hex file is loaded in proteus software to run the stimulation. In this project the UV rays from morning 8 Am to evening 4 Pm is monitored, which is displayed in the LCD monitor. This is also transmitted using USART, which is displayed in the virtual terminal. Instead of Flood sensor a switch is connected in ADC channel 0. If the sensing value is greater than 10, then Reservoir Flood detection message is displayed and transmitted in USART. The Main objective of this project is to Monitor and Detection of UV Rays and Reservoir Flood detection. In our wireless sensor network we are using UV rays and flood detection as two nodes and the detected values are transmitted using Zigbee protocol to the Server. In this simulation the two nodes are combined together only for simulation purpose. UV Ray sensor automatically detects the rays from morning 8AM to evening 4PM. Continuously it receives the rays and the values are transmitted for every ½ hour to the serve

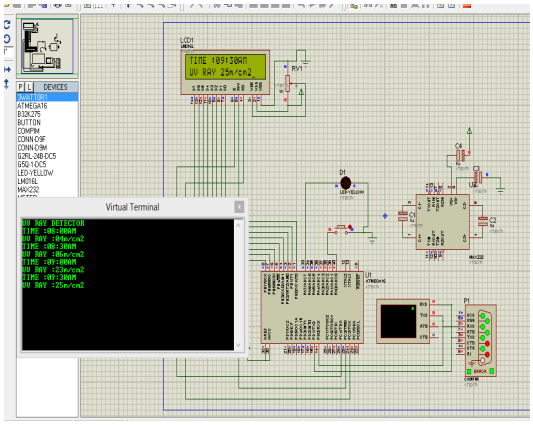


**Figure 7:simulation of UV-Rays detection output**

In simulation Virtual Terminal is connected instead of Zigbee, when we transit the data's in serial port, virtual terminal displays the data. Simultaneously displays in LCD. For flood detection in reservoirs, flood detection sensor is used it act as non contact type switch, in simulation we used a switch to manually to detect the water level, when water level raises the switch is closed in the sensor instead we manually press the switch to close. When we press the switch Flood detection alarm Led glows, message is transmitted to serial port and displays in virtual port and simultaneously displays in LCD.

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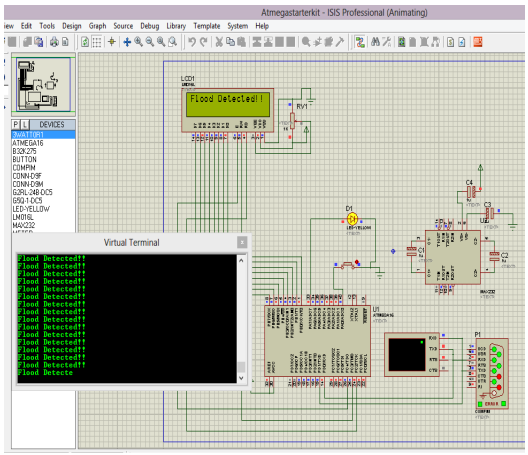


**Figure 8:Simulation of flood detection output**

**Conclusions**

The components are implemented and support for the operation of a broad range of indoor and outdoor field deployments. Two different nodes to detect the level of variation in these fields and the data will be transmitted and received through zigbee. The received data will be send to server through internet and also through the mobile. As the communications are doing wireless using the zigbee and gsm protocols the information can be transmitted at any local or central point where can be process the results, stored to controller and to the server, generating alarms when the values are in the High or Very High level in these nodes.This particular design was successfully verified in simulation process.

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