

# Solar Powered Water Quality Monitoring System Using Zig-bee

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**Abstract.** This work presents a solar power based water quality monitoring wireless sensor network (WSN) technology, to screen water quality over various destinations as an ongoing application, an astounding framework engineering comprised by disseminated sensor nodes and a base station is proposed. The model and base station are associated utilizing WSN innovation like Zig-Bee. Modeling and implementation of a proposed model using one node powered by solar cell and WSN technology is the challenging work. Data collection by different sensing element at the node side like pH, turbidity conductivity, saltiness and temperature is sent by means of WSN to the base station. Information gathered from the distant site can be shown in visual organization too as it very well may be examined utilizing diverse reproduction apparatuses at base station. This original framework has benefits like no fossil fuel byproduct, low power utilization, more adaptable to send data at far off site, etc.

**Keywords.** WSN; Conductivity sensor; Salinity pH sensor; Turbidity; Zig-Bee, Water quality monitoring; Solar power

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## 1. Introduction

Water is a limited asset and it is fundamental for endurance on earth including horticulture, industry and creatures. Checking of water quality is important to control the physical, synthetic and organic attributes of water. It gives data about the ebb and flow strength of the water body, regardless of whether the water body meets the predefined use and how it has changed over the long run.

The data gathered can be utilized to pass on that the water body needs improvement to meet its expressed use and to lead activities to secure and reestablish the strength of the water body. For instance, drinking water ought not to contain any synthetic substance that is hurtful to wellbeing; the measure of sodium in water for horticultural water system ought to be decreased; some inorganic synthetics should contain less water for modern use [1]. Likewise, water quality checking can assist with identifying water contamination, release harmful synthetic compounds, and water tainting. Temperature, pH and turbidity are average gathered boundaries in water way, lake water quality observing frameworks.

Photovoltaic's (PV) is a technique for producing electrical power by changing over daylight into direct flow power utilizing semiconducting materials that show the photovoltaic impact. The

photovoltaic (PV) impact is the electrical potential created between two divergent materials when their normal intersection is energized with radiation of photons. The PV cell, along these lines, changes over light straightforwardly into power. A French physicist, Becquerel, found the PV impact in 1839. It was restricted to the research center until 1954, when Bell Laboratories created the principal silicon cell. It before long discovered application in U.S. space programs for its high force creating limit per unit weight. From that point forward, it has been widely used to change over light into power for satellites. Having developed in space applications, PV innovation is presently spreading into earthly applications going from fueling distant destinations to taking care of utility networks around the world [2]. A photovoltaic system utilizes sun based boards made out of various photon cells to supply usable solar power. Power from solar PV has for quite some time been viewed as a clean maintainable energy innovation which draws upon the planet's generally abundant and broadly circulated sustainable power source – the sun. Making a preventive move for quality up keep. We got a thought that a framework ought to be carried out. Screen water quality in a simple manner so it very well may be done without any problem. Examine some significant and significant elements of water [3]. Different natural parameters like temperature, Water can cause pH, oxygen thickness, turbidity, etc. gathered by these systems utilizing different sensors.

WSN innovation furnishes us with a way to deal with constant information Acquisition, Transmission and Processing. Overall Users can get ongoing water quality information distantly, however the framework has a few nodes and a base station where every node has a bunch of sensors and nodes are dispersed in different water bodies. By those sensors Data gathered in water is shipped off base station by means of WSN Channel. Essentially a PC with realistic UI (GUI) is utilized as the base station for the user [4-5]. To break down. Water quality information and when water quality is distinguished. Underneath the foreordained level, the alert is naturally raised. Utilizing the Various instruments can record the information for future correspondence and works.

## **2. System Architecture of Photovoltaic Cell**

PV cells are consists of semiconductor materials, like silicon. For sun oriented cells, a slim semiconductor wafer is uncommonly treated to shape an electric field, positive on one side and negative on the other. At the point when light energy strikes the sun based cell, electrons are thumped free from the molecules in the semiconductor material. In the event that electrical conveyors are connected to the positive and negative sides, framing an electrical circuit, the electrons can be caught as an electric flow - that is, power. This electricity can then be used to different utensils. A PV cell can either be round about or square in development.

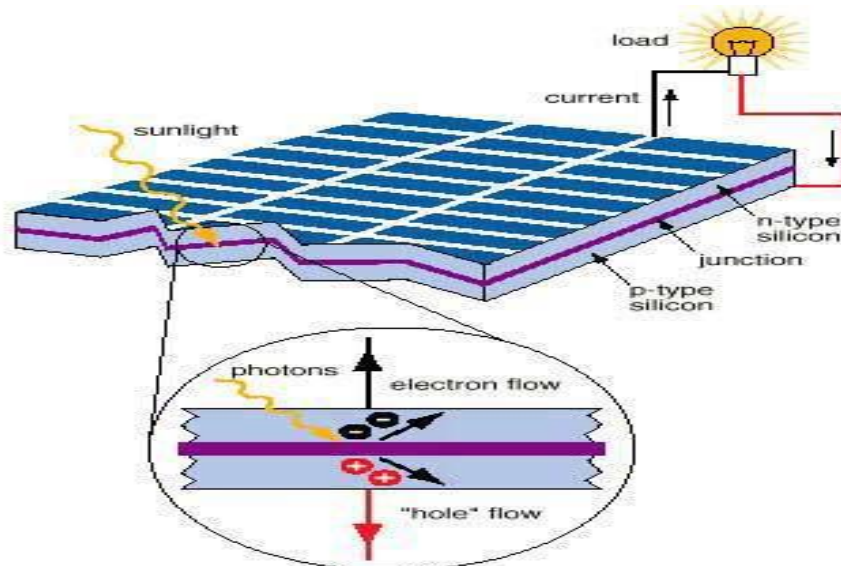
### **2.1. Photovoltaic Module**

Because of the low voltage created in a PV cell (around 0.5V), a few PV cells are associated in series (for high voltage) and in equal (for high current) to shape a PV module for wanted yield. Separate diodes might be expected to stay away from invert flows, if there should be an occurrence of incomplete or absolute concealing, and around evening time. The p-n intersections of mono-translucent silicon cells might have satisfactory converse current attributes and these are excessive. Switch flows squander control and can likewise prompt overheating of concealed cells. Sunlight based cells become less proficient at higher temperatures and installers attempt to give great ventilation behind sun powered boards. Creating power from sun oriented PV has for quite some time been viewed as a clean practical energy innovation that draws in the world's generally abundant and broadly circulated sustainable power source - the Sun. The immediate change of electric daylight happens during activity with no moving parts or natural discharges.

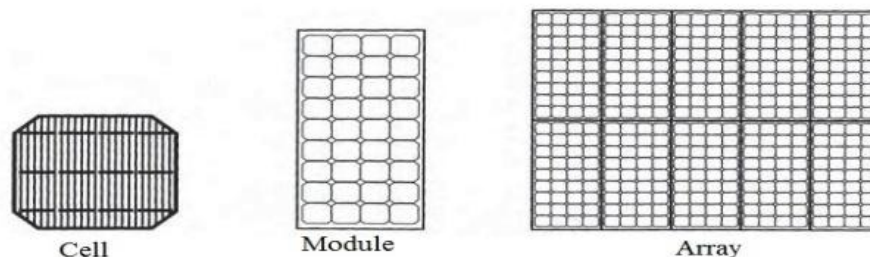
### **2.2. Photovoltaic Array**

The power that one module can deliver isn't adequate to meet the prerequisites of home or business. Most PV exhibits utilize an inverter to change over the DC power into converting AC current that can

control the machines, loads, lights and so forth. The modules in a PV exhibit are typically first associated in series to get the ideal voltages; the individual modules are then associated in corresponding to permit the framework to create more current.



**Figure 1.** Basic Structure of PV cell.



**Figure 2.** Several PV cell makes a module and several modules make an array.

### 2.3. Zigbee

ZigBee is an IEEE 802.15.4-based particular for a set-up of significant level correspondence conventions used to make individual region networks with little, low-power advanced radios, for example, for home automation and other low-power low-transfer speed needs, intended for limited scope projects which need remote association. Thus, ZigBee is a low-power, low information rate, and nearness (i.e., individual region) remote specially appointed organization. The innovation characterized by the ZigBee detail is planned to be less difficult and more affordable than other remote individual region organizations (WPANs, for example, Bluetooth or more broad remote systems administration like Wi-Fi. Applications incorporate remote light switches, home energy screens, traffic the board frameworks, and other shopper and mechanical hardware that requires short-range low-rate remote information move.

Its low force utilization limits transmission distances to 10–100 meters view, contingent upon power yield and ecological qualities. ZigBee is commonly utilized in low information rate applications that require long battery life and secure systems administration (ZigBee networks are gotten by 128 bit symmetric encryption keys.) ZigBee has a characterized pace of 250 kbit/s, most appropriate for irregular information transmissions from a sensor or info gadget.



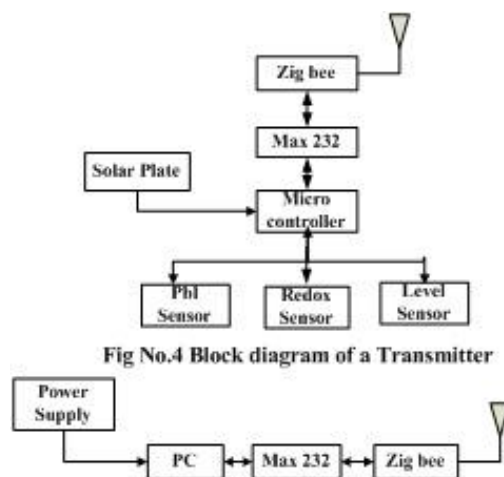
**Figure 3.** Zig-bee module.

Water is a fundamental asset of daily routine for each experiencing organic entity on the earth. Water quality, oxygen level check assumes a significant part in water. Human medical problems, Plants and living beings on earth rely upon water quality. Downpour, pools of streams is its fundamental sources water. Water streaming over the ground has numerous valuable just as destructive fixings, dissolvable or may insoluble. Salt and particles in soil decide corrosiveness water. An insoluble molecule gets blended in Water utility for unique application, where straightforwardness is the customary proportion of water quality.

To measure oxygen level, causticity, and aggravation of drinking water just as water that might happen. The primary intention is to use for farming and mechanical cycle. Water decreases the utility of water particularly for application. The primary target is to quantify pH, saltiness, conductivity, Temperature and turbidity of drinking water just as water utilized for horticultural and modern cycles.. Parameters to be analyzed and control oxygen levels to further develop water properties, PH and turbidity. Thought execution targets are as per the following..

- Measurement of pH, oxygen level and turbidity Water utilizing sensor at far off area.
- To take advantage of local power supply to sensor nodes using solar power.
- To gather information from different sensor hubs and send it to base station by remote channel.
- To control information correspondence among source and sink hub. (Synchronization utilizing time division)
- To simulate and analyzed quality principles for quality control. (Graphical and mathematical records utilizing VB and MATLAB) To distribute related records on the web for additional evaluation of public data and water assets.

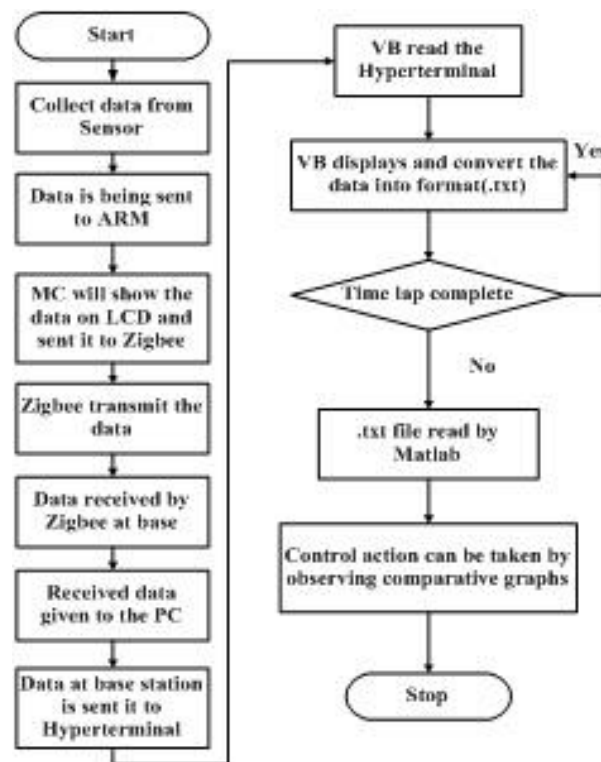
The detailed block diagram of water quality monitoring system is shown in block diagram Figure 4.



**Figure 4.** Block diagram of a receiver.

### 3. Software Design

Programming configuration approach for water observing framework depends on three sections, first is ARM programming, GUI design plan in VB and MATLAB recreation of results acquired from base module. Point by point flowchart for the working of entire framework just as programming configuration is displayed in figure6. This framework we utilized MATLAB graphical portrayal for estimating the different degrees of water quality like Ph, turbidity, oxygen level. our proposed flowchart portrayal is clarified as follows Figure 5.



**Figure 5.** Flow chart for general water flow of water quality monitoring system.

### 4. Application & Future Scope

The objective of this undertaking is to plan and deal with a remote sensor Network (WSN) that helps screen water quality with the assistance of data by water inundated sensors, to portray water assets inside a standard Can be saved for To have the option to make essential moves to reestablish the health of homegrown use and debased water body. A powerful transmission with a WSN802.15.4 viable handset highlighting Zigbee-based innovation is picked as a result of its effortlessness of organization, minimal expense, low force utilization, dependability, and high scalability. This framework checks nature of water at where for the most part it is badly designed to step through continuous examinations physically.

The running water over specific land gets blended in with salt and different materials which change the pH worth and turbidity. It is not difficult to observed and control the water contamination by this cycle. The higher turbidity and imbalanced of pH in water supply utilized for drinking, farming and industry use is a major issue. At such spot the quality control should be possible by checking and important activity for quality improvement

To screen nature of water in different destinations, future works can be centered around building up

a framework with more sensor nodes and more base stations. Nodes and base stations are associated as WSN; the distinctive base stations are associated through Ethernet. The Ethernet can likewise be associated with web so the client can only login to the framework and get continuous water quality information distant. The remote information obtaining from distant spots and data set stockpiling is the supporting construction of the framework which can be utilized for additional exploration contemplates like soil content examination utilizing various test systems.

The simulation can be utilized for water contamination control in changing conditions. And utilized to figure strange minutes in ocean stomach by estimating the turbidity at the beach.

## 5. Conclusion

Overall, the proposed model of a solar-powered water quality monitoring system using Zig-bee based WSN for water quality monitoring systems that provide minimal power consumption with high quality is presented. Performance modeling in different environments is an important aspect to be studied in the future as different types of monitoring applications require different configuration during system installation. This framework gives exhaustive assessment of water climate as well as can rapidly find earnest water contamination mishaps or catastrophic events, moving the strange water quality data to observing focus by quicker correspondence communication and gives graphical references to the corresponding office to understand the situation of the disaster to build up the counteraction and fix strategy.

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