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Water Quality Monitor in Fish Ponds by using Wireless Sensor Networks

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Abstract— In fish ponds, the quality of water must be monitoring with the help of Wireless sensor networks. In this work, for water quality monitoring in aquaculture tanks to design set of sensors. The Wireless sensor network is based on substantial sensors, tranquil of trouble-free electronic machinery. The anticipated structure can supervise water quality in accumulation that the system includes a neat algorithm to condense the power dispel when transport the information from the node to the directory. The arrangement is together of three nodes in each tank that drive the information though the local area network to a database on the internet and a efficient algorithm that detects asymmetrical values and sends sound the alarm whereas they obtain position. All the sensors are premeditated and assemble to guarantee its appropriateness.

Index Terms— aquaculture; water excellence; substantial sensors; wireless sensor network

I. INTRODUCTION

For the Fish meat aquaculture is a promising option, fish consumption will permit a significant amplify by 2050 [1]. For different conditions it will be implementing. Different type of amenities are developed in ocean even though some facilities available in inland. To eliminate the turbidity, filters can be used in water entrance then the negative effectives of turbidity are reduced for improving fish performance [3]. Usually not modified the parameters of water temperature and water conductivity but it are possible to modify. The parameters of water are conductivity and temperature can alter the feeding necessities of fish held in reserve in the tanks [2].

The main aim of this work is to monitor water quality in aquaculture tanks by using low-cost wireless sensor. to determine different parameters of water the systems is collected of different sensors. the parameters are temperature, turbidity, or conductivity, among others. for organize the different parameters in fish tank by using nodes. the server receives the statistics from access point (ap) that are linked by nodes. in the internet and on the local area network data is available.

II. RELATED WORK

For water quality monitoring few authors given dissimilar systems. Water superiority monitoring and fish performance monitor be vital toward acquire better effectiveness of aquiculture. Wireless Sensor Networks (WSN) has grown to be a justification for the water feature monitor. Francisco J. Espinosa-Faller et al. explained in [4] a WSN-based water monitoring arrangement. In this method Zig-Bee is used to drive the information collect by the sensors from the recirculation group. Temperature, pressure, and dissolved oxygen be measured all the manner through the date. While a problem was detected, an SMS was forward to alert the person liable for the ability. Another WSN-based water monitoring system was presented by Mingfei Zhang et al. in [5]. Finally, messages were forward via SMS or graphical mechanism flash to the users. The water eminence check collection accessible by Daudi S. Simbeye et al. in [6] measured water pH, level, temperature, and dissolved oxygen and engaged ZigBee to advance an in sequence. In addition, more than a little experiments concerning message presentation, battery performance and sensor readings to be performed more than a time of six months. Xiuna Zhu et al. explained [7] a water importance monitoring system for fish farms. It employed artificial neural networks (ANN) to expect water quality to stop losses. The information was next forwarded to a server to be rather access. Gianni Cario et al. presented [8] fish ponds water quality monitoring system. Likewise, energy spending was compact

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employ original snooze plus acquires positive mechanisms.

The systems for water eminence monitoring evaluate the same parameters not allowing for other significant factors to monitor such as the turbidity of the water. In addition, many of the papers do not specify which sensors they have utilized, or they employ expensive sensors, resulting in a high-cost system that is complicated to execute in fish farms with few resources. In this job, we present a low-cost water brilliance monitoring system.

III. Materials and Methods

In this section, the structural design of the projected system is offered and the engaged significant sensors and its conditioning circuits are described.

Architecture: The formation is based on sensors for monitoring unlike parameters such as water quality, tank parameters and moisture inside the node boxes. The three nodes are monitoring in each tank at dissimilar parts of the tank. The working nodes send the information wirelessly to the access points. The substantial topology is shown in Figure 1. dissimilar box nodes are positioned in some points of the services. The nodes are wirelessly connected to the access point using Wi-Fi technology.

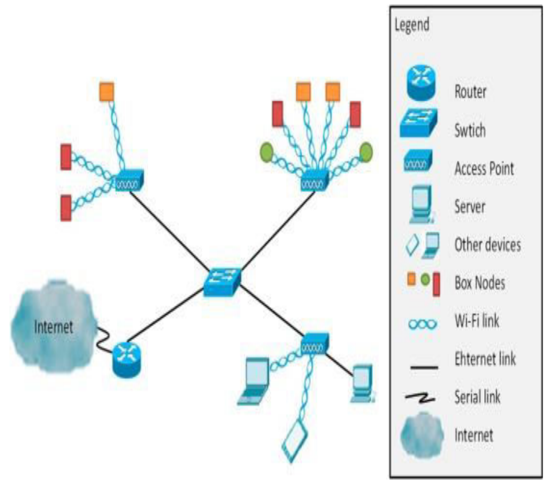

Fig 1. Network topology proposed.

The Access Points are coupled to the switch with an Ethernet link. Several Access Point s are positioned at dissimilar points of the amenities; a few of them are located in the rooms with the production tanks. Staff receive the signal if any alarm message are generated from the Access Point. Finally, the switch is linked to a router to have internet access with a serial connection.

The structural design of the whole systems is shown in Figure 2, together with the folder and the neat algorithms functional in the cloud. The figure 2 shows the location of the sensor and box nodes in the fish ponds. All the sensors are located in box nodes. In addition, the box nodes contain humidity sensors also. In usual situation, the nodes sense the signals and send the information to the documentation.

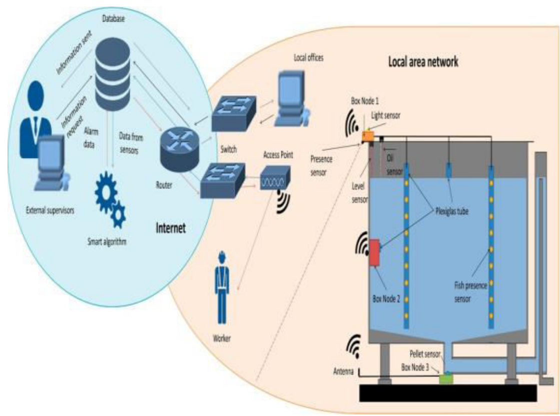

Fig 2. Architecture of the proposed system.

Water Parameters: Here demonstrate the engaged sensor for temperature monitoring. Here the thermistor type negative temperature coefficient was employed. The advantage of the Negative Temperature Coefficient is the linear relationship sandwiched between resistance and temperature. The employed NTC is the NTCLE413E2103F520L.

To find out the turbidity by using two main methods these are acoustic and optical methods. Here we are using the optical method. It is composed of an IR light emitting diode (LED) and an IR photo detector. The IR photo detector offers a fast response, Turbidity increases when the resistance of the photo detector decreases. The relationship between these two is linear. However, the expected values of turbidity in fish farms are low. Only in adverse conditions the turbidity values can increase. The turbidity sensor can be seen in Figure 4.

Node: To collect the data from all sensors, we have selected a compatible Arduino Mega 2560 module. This microprocessor board has 54 digital input/output pins, 16 analog inputs, 4 UARTs (hardware serial ports), 16 MHz crystal oscillator, USB connection, power jack, In-Circuit Serial Programming (ICSP) connector and reset button. Here we are using Wi-Fi module ESP8266 ESP-01 [9] and a micro SD card reader which will be connected to our microprocessor module as shown in Figure 3.

IV. Results and Discussion

Here we are expose all the sensor result for quality of water in the fishponds are shown. For operation in the system, it is necessary to obtain the data as the output voltage (V_{out}) that arrives at the node. From the NTC, based on the data offered by the manufacturer it is possible to extract the expected resistances at different

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temperatures. To increases the difference of V_{out} min and max values of NTC resistance a voltage divisor must be used. An R_2 of 12 KΩ must be used and the NTC is used as R_1. We can calculate the V_{out} of the NTC at different temperatures. The data and the mathematical model that follows this data are presented in Figure 4. The relation between V_{out} and NTC temperature can be seen in the below equation (1). The correlation coefficient of equation (1) is 0.9995. The formula that relates the temperature and the volt-temp value is extracted from Equation (1).

$$Temperature\ (^\circ C) = 0.0309 \times V_{out}\ (V) + 1.1947 \cdots (1)$$

Using the V_{in} of 3.3 V the infrared photo detector as R_1 and R_2 of 6 MΩ increase the difference between the max and min V_{out}. The data after applying the voltage divisor and the mathematical model that adjust to this data are presented in the Figure 5.

$$Turbidity = 1764.5 + 1032.4 \times V_{out}^2 - 2746.5 \times V_{out} \cdots (2)$$

The node resolution was consider, the min variation of turbidity that can be detected by the turbidity sensor goes from 1.8 NTU in low turbidity circumstances to 4 NTU in high turbidity circumstances. The formula that relates the turbidity and the volt-turb value is obtained from concerning the data shown in Figure 5.

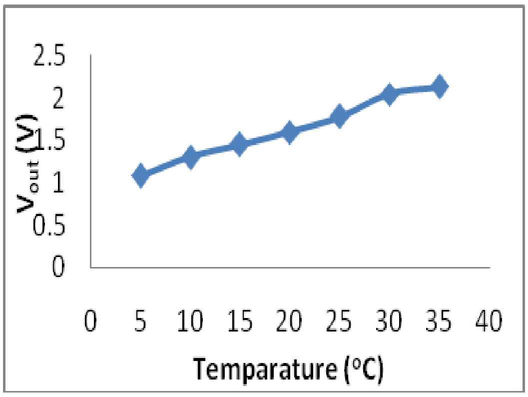

Fig 4. Temperature sensor data.

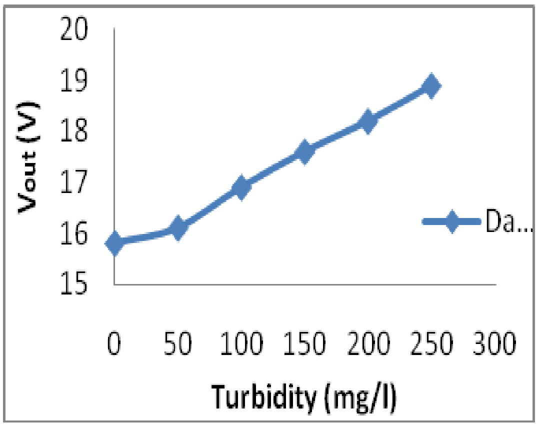

Fig 5. Turbidity sensor data.

V. Conclusions

The arrangement can control the changes in water parameters throughout the feeding procedure. Temperature, conductivity and turbidity are the monitored water parameters. All the sensors are designed and calibrated for their appropriateness for the aquaculture monitoring has been showing. Neat algorithms were deliberate to moderate the use of energy in the information transmission from the node to the database.

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