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Tracking of Treated Industrial Waste Water in the Field

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Abstract*: Untreated industrial water discharges into existing waterbodies and onto land have degraded their quality and are now dangerous and catastrophic for aquatic and human life. Even treated industrial effluents have frequently been shown to be hazardous. Therefore, an attempt has been made in the project described below to test the treated industrial waste water and report the results to the pollution control board and the relevant industry. The water was tested using a thermistor, purity sensor, conductivity electrode (k=2), and pH electrode (PE03). ZigBee was then used to transmit the data from the aforementioned sensors to the pollution control board and industry control room.*

Keywords*: Thermistor, GSM, pH electrode, Conductivity, purity sensors*

I. Introduction

Generally used for both residential and agricultural purposes the water disposal from the treatment facility needs testing which measures its purity combined with conductivity and acid-base levels and temperature parameters. Testing treated industrial waste water is essential because operations of treatment facilities often go wrong leading to inadequate industry waste treatment processes. Wrong methods of treatment cause damage to aquatic ecosystems along with harm to human beings [4-6]. The treated industrial water receives two functions: irrigation purposes followed by its direct drainage release into rivers and big bodies of water. Inadequate treatment of the water will have catastrophic consequences for aquatic life as well as human life. Using untreated or partially treated wastewater and effluents for irrigation could pose risks to human health and the environment. The impact of industrial effluents on human and aquatic life has been covered in earlier works. It primarily highlights the necessity for additional advancements in industrial waste water treatment techniques.

Testing of the treated industrial waste water is the foundation of the project that is being detailed here. For the purpose of this project, the pH, temperature, conductivity, and visibility of the industry's treated water will all be measured. The data will be transmitted by ZigBee to the industry control room. The industry's treated water is being tested using the following sensors [6].

Conductivity sensor
Temperature sensor
Purity sensor
pH electrode
Conductivity sensor

II. Related Work

High concentrations of contaminants were found in the water and sediment as a result of Nigeria's receiving water bodies being exposed to industrial effluent discharge. There was a concentration of the contaminants that could be harmful to various organisms. This paper's goals were to ascertain how industrial effluents affect the water quality of Nigeria's receiving rivers and to raise public awareness of the consequences of disposing of industrial effluents prior to pre-treatment [1].

The engineering, paper mill, fine chemical, dyes, paint, pharmaceutical, petrochemical and textile industries together cause the pollution of surrounding aquatic environments in Taloja Industrial Area of Mumbai as shown by a study of waste water effluents. The observed results from the effluent sampling show that industrial recreation centered pH readings were found outside the recommended 6.5 to 8.5 range.

III. Specifications and Sensors

The pH electrode determines whether the examined solution or water exists as acidic or alkaline or neutral. Most water-based chemical reactions throughout aquatic systems are influenced by shifting pH values thus making this measurement essential [5-6]. A pH-electrode consists of two fundamental parts that include an active sensor and a reference sensor. Physical combination between both electrodes forms a single electrode system. The combinational electrode consists of a glass electrode which is surrounded by a concentric reference electrode. The AgCl reference electrode functions through silver wire contact with its insoluble material.

The measurement process relies on using KCL filling solution which serves as the connection point to the tested solution. The porous diaphragm serves as a seal which stops mixing between the filling solution and solution to be measured. A tiny voltage output of 0.06 volts appears per pH unit during the function of pH measurement sensors. The probe generates a voltage which shows difference between different solutions. ADC receives the recorded voltage which has been measured. The microcontroller receives digital information through ADC from the ADC conversion of its input signals. The conductivity sensor detects the entire concentration of electrolytes in aqueous solutions. This instrument determines solution electric conductivity levels. Measuring the conductance which opposes resistance represents the actual reading method of conductivity sensors.

IV. Experimental Setup

Experimental setups integrate a pH electrode, conductivity, purity, and temperature sensors with ADC0808, microcontroller AT89S52, LCD, and ZigBee along with them. The ADC performs the essential role of digitizing sensor output signals that it receives from the microcontroller prior to transmission. The analogue signal cannot be processed by the microcontroller so the transformation to digital format occurs. The ADC0808 digital converter features eight analogue channels for input which operates as a device with 8-bit conversion power. The digital form of selected input can be accessed through addressing lines number one through three. Users have two voltage options for creating the reference (vref- and vref +).

The step size gets established through the specified reference value. Using 5V as its reference value leads the ADC to default to a step size measurement of 19.53 mV. It takes 100 µs to convert. It operates at 25 mW. The device requires a separate clock component in order to operate. The AT89S52 microprocessor contains 12K bytes of in-system programmable flash memory which makes it a CMOS 8-bit microcontroller of low power and high-performance design. The device contains two distinct serial interfaces as well as built-in clock generation and memory storage space of 256 bytes and I/O capabilities of 42 and Watchdog functionality and two data storage locations and three timer modules along with interrupt processing capabilities through two stages of vectoring [6].

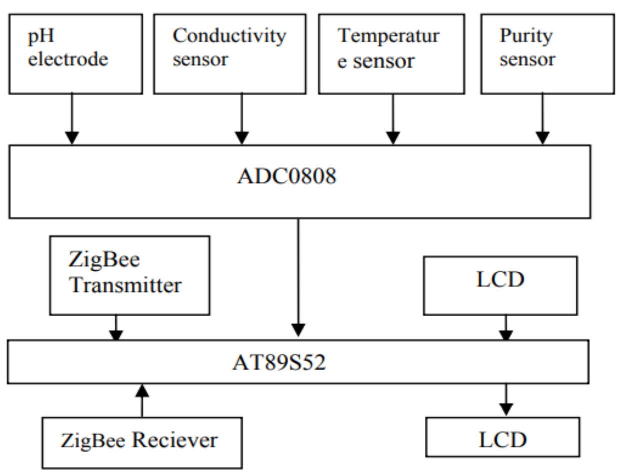

Fig 1: Block Diagram of the experimental setup

The AT89S52 offers user's manual control of two power-saving states while its static logic capability allows it to run at zero frequency. The operating limit reaches 2000 cycles for write and erase functions. Users can set up its serial communication channel through programming. The At89S52 device provides power saving operation through multiple modes and reaches optimal power efficiency. Since the pH sensor is an active component, no power source is required. Between the reference electrode and the glass electrode, an electric potential will be generated. Water to water, this voltage will change. After being converted into digital form by the ADC, the acquired voltage is subsequently transmitted to the microcontroller. When submerged in the solution, a conductivity sensor will exert force on the water's charged ions, pushing them towards the cathode or anode. Current will flow as a result of the ions moving through the solution. The conductivity of the solution determines how much current flows through it. The current is further transformed into voltage. After conversion, this voltage is sent to an ADC and then to a microcontroller.

V. Results

For six days, the setup is evaluated, and the treated industrial water is replaced every day. The graph below displays the tracked outcomes for each day following testing.

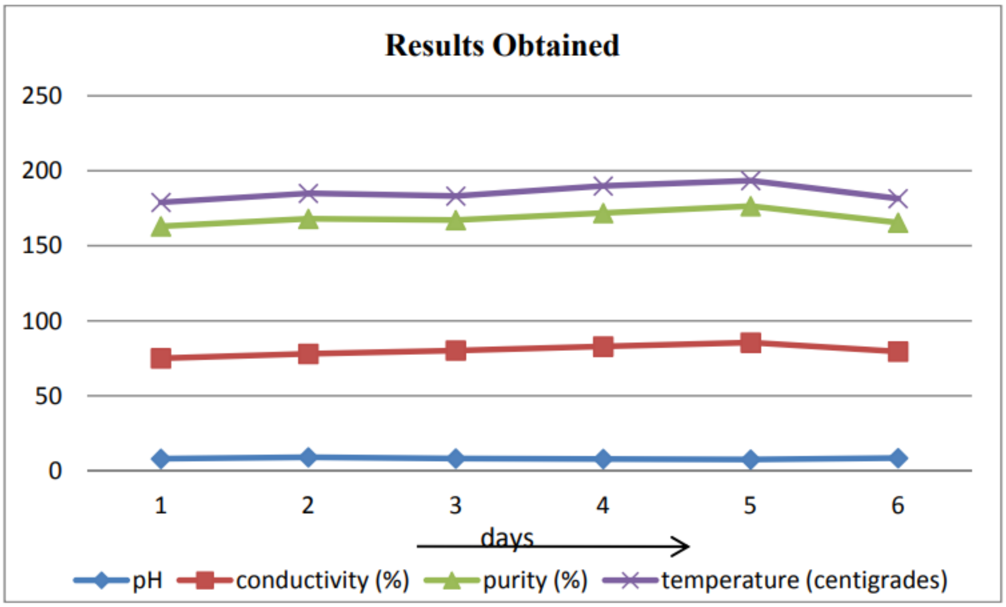

Fig 2: Graph for Obtained Results

VI. Conclusion

Air and water pollution are both rising as a result of increased industrialization. As a result, treating industrial wastewater alone is insufficient. Therefore, an attempt has been made to test the industrial wastewater that has been treated. Water from the leather industry's treatment plant has undergone tests for pH, conductivity, purity, TDS, and temperature. Following testing of the treated water, it was determined that the parameters under consideration fluctuate in value based on the effluents that remain in the water. Water's conductivity increases with the number of impurities present. If the water is not correctly treated, the pH, purity, and TDS values also vary.

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