

## Artificial Intelligence Based DAM Monitoring and Water Quality Measurement System

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**Abstract-** In order to enhance reliability and safety procedures of the dam, it is very important to gather dam behavior data in real-time monitoring system. The main aim to implement the automatic dam monitoring based on 8051 microcontroller is mainly designed to precisely measure, store and transmit various parameters output to the computer server. These sensor systems monitor the condition of the dam automatically by sensing water acidity level, water conduction level, pressure and temperature level of the dam. The sensor output is signal conditioned and it is digitized by using an analog to digital converter. The microcontroller controls the operation of the ADC and the digital output of the ADC is transferred to the input port of the microcontroller. Then the transmitter section transmits that digital output to the receiver section. When the water level of the dam goes above a threshold level the microcontroller automatically turns ON the Buzzer to indicate the critical condition. In the receiver section will be having GSM Modem to send the condition that presents in the dam to the supervisor and nearby people of the dam. The communication between transmitter and receiver is zigbee for the real time application for high reliability.

**Keywords:** zigbee, ph Sensor, Level Sensor, Temperature Sensor

### I. INTRODUCTION

Many cases of dam failures in history manifest the lack of the warning system. In order to enhance the safety, the dam needs to have the monitoring system. The traditional method for dam monitoring system requires a lot of operator to measure sensors manually and it is not practical in some situations where critical inspection points are not accessible. In the modern safety dam system, an automatic monitoring system provides more comprehensive information by using instrumentation. This system also provides the real-time information via reliable zigbee communication. With this useful information, supervisor and operator staffs can improve their ability to responsibly operate and maintain the dam in a safe manner. The sensors installed into dam's structure and in reservoir measure physical quantities of interests such as flood detection, ph level, and pressure and temperature parameters.

The aim of this paper presents the both transmitter and receiver section that operates in the dam monitoring system. The transmitter section based on 8051 microcontroller is mainly designed to precisely measure, store the analog value of instrument sensor devices related to dam behavior. The transmitter section communicates with computer server using zigbee communication.

### II. PROPOSED SYSTEM DESIGN

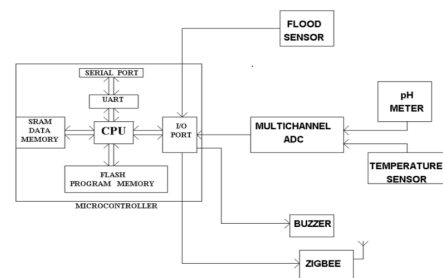


Fig. 1 Block diagram of transmitter section

The fig.1 consists of a Controller, Sensors, and Zigbee module and power supply unit. These circuits are compatible and enclosed in a dam. The dam serves both for physical protection and also for protection against receiver. When a water level is above the normal level, it is detected by the flood sensors. In dam, temperature, water acidity levels are evolved. This is detected by the respective sensors. Each and every sensor has its threshold value. The values are measured in ppm (Parts Per Million). This section also consists of a relay circuit in order to rescue the dam parameters and also a zigbee module is used to transmit the information to the receiver.

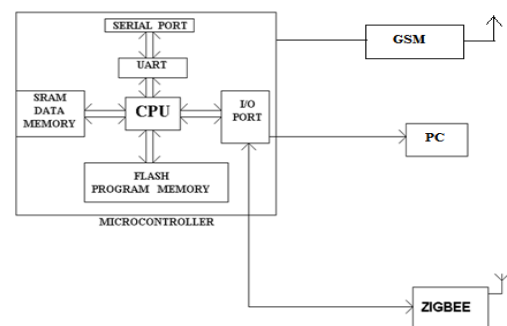


Fig. 2 Block diagram of a receiver section

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The Fig 2. consists of Zigbee module, PC and microcontroller. It receives the information from transmitter section. PC system is used to note the parameters of the dam and if the parameters threshold level may reach or goes above the given threshold level then it can be controlled by itself. The GSM used in this is used to send the indication to the supervisor and the near by people for the safety manner wherever they localized.

### III. HARDWARE DESIGN

#### A. Atmel89s51

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4Kbytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out.

The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry.

#### B. TEMPERATURE SENSOR LM35

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of  $\pm 1/4^\circ\text{C}$  at room temperature and  $\pm 3/4^\circ\text{C}$  over a full  $-55$  to  $+150^\circ\text{C}$  temperature range.

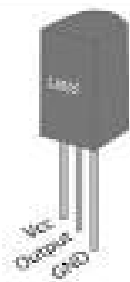


Fig .3 LM35 sensor

Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or

control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only  $60\text{ }\mu\text{A}$  from its supply, it has very low self-heating, less than  $0.1^\circ\text{C}$  in still air.

#### C. pH Sensor



Fig .4 pH sensor

In the process world, pH is an important parameter to be measured and controlled. The pH of a solution indicates how acidic or basic .The pH term translates the values of the hydrogen ion concentration- which ordinarily ranges between about 1 and  $10 \times 10^{-14}$  gram-equivalents per liter - into numbers between 0 and 14. A pH measurement loop is made up of three components, the pH sensor, which includes a measuring electrode, a reference electrode, and a temperature sensor; a preamplifier; and an analyzer or transmitter. A pH measurement loop is essentially battery where the positive terminal is the measuring electrode and the negative terminal is the reference electrode. The measuring electrode, which is sensitive to the hydrogen ion, develops a potential (voltage) directly related to the hydrogen ion concentration of the solution. The reference electrode provides a stable potential against which the measuring electrode can be compared.

The pH sensor components are usually combined into one device called a combination pH electrode. The measuring electrode is usually glass and quite fragile. Recent developments have replaced the glass with more durable solid-state sensors.

#### D. Flood sensor

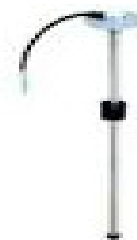


Fig.5 flood sensor

The Model CDE-45P flood Sensor measures the conductivity of aqueous solutions in industrial and municipal process applications. It is designed to perform in the harshest of environments. All seals are dual o-ring using multiple sealing materials. The sensor is designed for use with the Omega CDTX-45 Monitor/Analyzer.

#### F. RF module

XBee and XBee-PRO Modules were engineered to meet ZigBee/IEEE 802.15.4 standards and support the unique needs of low-cost, low-power wireless sensor networks. The

modules require minimal power and provide reliable delivery of critical data between devices. The modules operate within the ISM 2.4 GHz frequency band and are pin-for-pin compatible with each other.

When the received value from the sensor is above and below the threshold value, it carries out the transmission and reception operations.

#### IV. EXPERIMENTAL RESULT

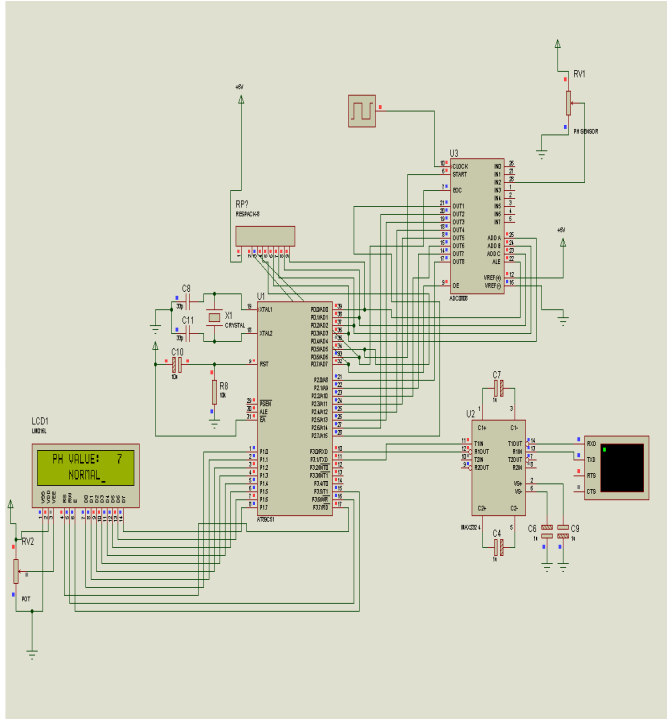


Fig.6 Simulated result of pH parameter

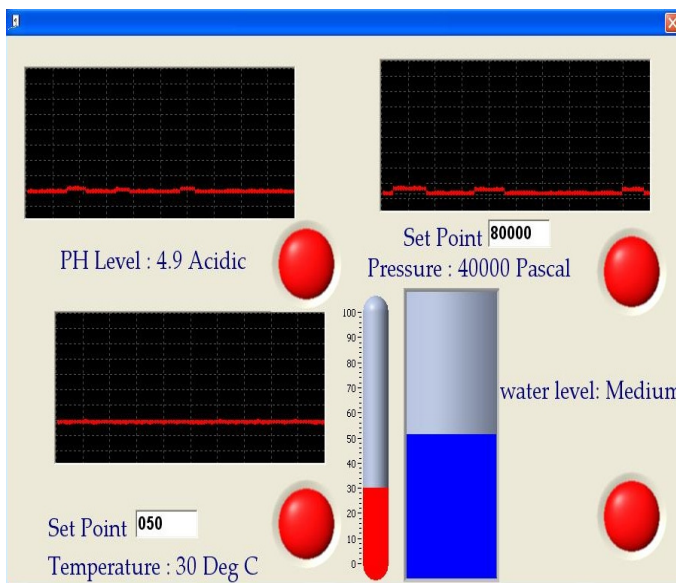


Fig.7 output of parameters

The above results show the effective management and water quality measurement in the dam.

#### V. CONCLUSION

There are two prototype sections, one is transmitter section and other is receiver section. The transmitter senses the condition of the dam for the presence of parameters. If exists, it communicates the receiver and find out the range of parameter of the dam. In the receiver section, if the condition exceeds the defined value of the water threshold value, it sends the information through GSM to the predefined person and alarm produces at the transmitter section. This prototype can sense the water level, water acidity level, pressure and temperature of the dam. It protects the dam from exposing of acidity and temperature. Another main problem is water acidity level. In order to reduce acidity, we would integrate a treatment system such as pH sensor for sensing the acidity value of the water and also want to reduce the acid level to exceeds the range.

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