

# Review on IoT Based Dam Parameters Monitoring System

Shankareppagol LM, Akshay Bajirao C\*, Yuvraj Praksh J, Radhika Ramesh P, Samruddhi Suryawanshi S, and Suhas Shankarrao H

Department of Electrical Engineering, Sanjay Ghodawat Institution, Shivaji University, Kolhapur, Maharashtra, India

## Abstract

Dam plays a major role in our life as they are used for purpose such as irrigation flood control and mainly generation of electricity. There are approximately 4200 major/minor dams in India. When it comes to monitoring the parameters of dam such as Water Level, Gate Position, Water Discharge and Seepage tank level the manual method fails. This project will help out to automatically measure as well as display the data parameters. The sensors connected to Raspberry pi 3 measures the parameters and shares the data through IoT to Website. The development of this project not only help to dam authority and disaster management to control the parameters as well as common people to know.

**Keywords:** Dam parameters; Raspberry pi 3; IoT; Dam Water level; Gate positioning; Seepage tank

## Introduction

Dam plays a major role in our life as they are used for purpose such as irrigation flood control and mainly generation of electricity. There are approximately 4200 major/minor dams in India. When it comes to dams, there are various parameter to be measured [1]. Now a day's dam authorities are facing problems regarding the dam and the weather parameters monitoring as most of the small dams are still using manual observation and older technique of transmission system. Manual observation and transmission result in considerable time lag between data observed, its transmission and for decision taking. Also, this causes loss of real time data and sometimes become the reason for upcoming disaster.

When it specifically towards water level measurement for water discharge to generation and irrigation. It has to be measure at least one time in 24 hours. Most of dam's measure water level manually as it not convenient to keep continues monitor on the change of water level. There is a need to look forward for an advance technology. So, we are about to design such a technology in which we will place a reflector on the water surface on which the transmitter will direct a beam on the reflector and by certain logics, the water level can be determined. This data is transmitted to dam authority and generation control authority.

This system will help to reduce this problem which facing by dam authority and continuous observation on water level of dam.

The project is proposed to implement a system with web portal which will monitor all the parameters such as water level, gate position, water discharge and seepage tank level. In observation part the smart controller provides facility of dumping sensor observation values directly into database with specific time interval. It provides the facility of SMS for providing data. As it is basically based on Internet data sharing with the help of web database, dam parameters to government authority etc., the Government of India wants to monitor the real time water level of reservoirs. Hence this work will help in Digital India Mission.

## Objectives

- To make the most commercial and reliable dam water level detector using as less resources as possible
- Develop the dam water monitoring system where the water level automatically detects by the sensor.
- The proposed system can monitor dam water level with higher data transmission speed.

- To develop a system to monitor Gate Level Monitoring and Seepage tank level Monitoring
- The concept of this system is to develop a web portal which will monitor and give authentic time parameter related to dam.

These objectives are in front to develop a complete system. Not only the reliability this system should also reach the cheapness such that we can monitor the data of all the dams.

## Methodology

The methodology consists of three different section of sensing, controlling and displaying. The block diagram for the expected project is shown in Figure 1.

The Location of Sensing Element Must be First Specified according to the Physical and Environmental condition it will be different in case of Dam water level, Gate opening and Seepage Tank. Selection of Sensors and other components with Correspondence to the site of Implementation which includes Mechanical as Electrical Parameters. The Height of Water level varies with huge span also we require high accuracy and sensitivity is needed. Hence the Ultra-Sonic Sensor is best suitable for the system. As the Errors in Gate Opening are not acceptable the digital display can minimize the observational errors

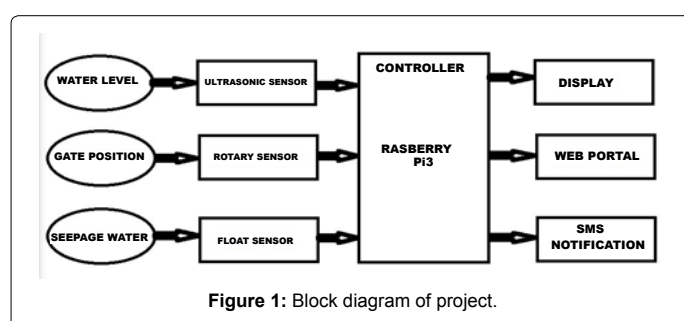


Figure 1: Block diagram of project.

**\*Corresponding author:** Akshay Bajirao C, Department of Electrical Engineering, Sanjay Ghodawat Institution, Shivaji University, Kolhapur, Maharashtra, India, Tel: +918329346131; E-mail: [akshaychavansgi@gmail.com](mailto:akshaychavansgi@gmail.com)

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thus, a Quick action can be taken. The seepage tank plays a vital role in dam operation which is often ignored but this ignorance can cause disaster. The Automatic Seepage tank management System including alarm is important for this scenario.

The Various sensor sense the parameter such as water level, Gate position, Seepage tank level and the data is feed to the Controller. The controller process on the data such as converting from analog to digital and the calculation of seance and gate Hight measurement. The raspberry is connected to the server which stores the data readied and recorded by the sensors. This data is displayed by the output devices such as Display, SMS Notification and Web Poral.

The Python is used to be used to make the programing in raspberry Pi 3.

Sensor

Three Major Sensors are used in the System

- A. Ultra-Sonic sensor
- B. Rotary Encoder
- C. Float Type Sensor

These three sensors sense the input parameter for the controller.

**A. Ultra-sonic sensor:** HC-SR-04: As shown above the HC-SR04 Ultrasonic sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively [2]. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which

forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that  $Distance=Speed \times Time$  the Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor. The time traveled by the wave is measured and the distance is measure. In this project the water will work as a reflecting media.

**B. Rotary encoder:** A rotary encoder is a type of position sensor which is used for determining the angular position of a rotating shaft. It generates an electrical signal, either analog or digital, according to the rotational movement. This sensor is connected to the shaft of the gate opening motor with the rotation of the gate motor the angle of sensor changes this angle is converted in terms of height of the gate opening.

**C. Float sensor:** The float type sensor is used to measure the seepage tank water level it changes its resistance as per the water level, since with the change in the water level the Hight is determined and the data is transferred to the web portal and alarm system.

Controller

The Raspberry Pi 3 Model B is used as the controller in this project. The Figure 2 shows the specification of Raspberry Pi 3 Model B.

Output

**A. Display:** The Displays at specific location such as dam authority office for continuous monitoring of data and the dam control location [3,4].

**B. SMS notification:** The SMS to the Authority of Dam and disaster management regarding parameters of dam is to be sent for continues eyes on the dam.

**C. Web portal:** The Web Portal is to be design which shows parameters from dam. The expected look of web portal is shown in Figure 3.

AutoPilot Mode

The Autopilot mode can be implemented in this project such as the desired values are set in the controller and dam will works still the desired vales are reached by the sensors.

Like if the dam level is to be ser around 100 m then the gate will remain open to reach level up to 100 m by reaching the desired value the controller will give command to the sensors.

Raspberry Pi 3 Model B	
Introduction Date	2/29/2016
SoC	BCM2837
CPU	Quad Cortex A53 @ 1.2GHz
Instruction set	ARMv8-A
GPU	400MHz VideoCore IV
RAM	1GB SDRAM
Storage	micro-SD
Ethernet	10/100
Wireless	802.11n / Bluetooth 4.0
Video Output	HDMI / Composite
Audio Output	HDMI / Headphone
GPIO	40
Price	\$35

Figure 2: Specifications of raspberry.

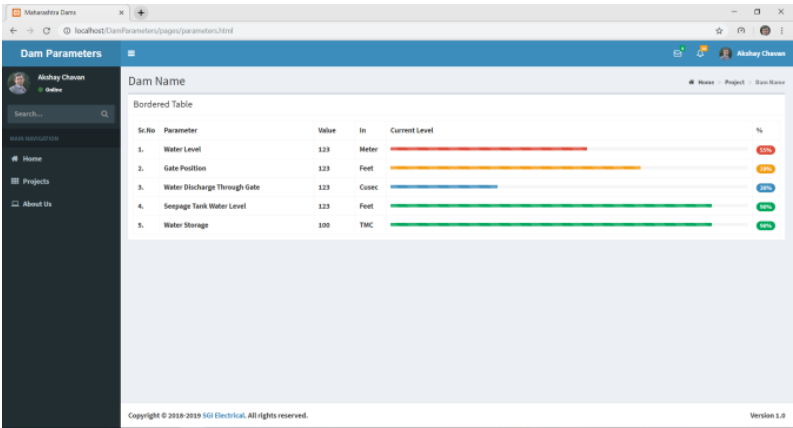


Figure 3: Web portal.

This is implemented by the machine learning and artificial intelligence in the project.

## Conclusion

This system will help dam authority to know the dam parameters without checking manually by the mean of Display, SMS Notification and Web portal. It is based on IoT Hence the speed of data transmission is high and probability of losing real time will be less.

This system is reliable and cheaper to install in every dam and a web portal can provide detailed parameters of all dams in India.

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