International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 12 | Dec 2020 www.irjet.net p-ISSN: 2395-0072

A Review on Different Water Level Monitoring Systems

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Abstract - *Water scarcity and its pollution all over the world is becoming a global issue. Hence it is of great importance to preserve water even in small amounts. Today's modern technology is largely depending on automation to control various systems. Most of the people in rural areas still face a lot of problems in regard to water scarcity whereas in urban areas a lot of water gets wasted unnecessarily on a daily basis. Thus all the people from different sectors of the world are unable to get their equal share. In order to slower down the wastage of water a Water Monitoring System can be used in sorting out these issues. In this paper we have reviewed various methods of monitoring the water level with various devices.*

***Key Words*: Water, scarcity, monitoring system, automation, modern technology.**

1. INTRODUCTION

Water is one amongst the most basic necessary survival elements which we need in our day to day life. So saving it from getting wasted must be our primary concern. In arid regions of the world, water scarcity is a major problem. If we keep wasting water continuously it can be a very dangerous problem in future. For instance let's take a simple situation where water overflows from the tanks when it gets filled but if it is noticed well in advance then a lot of water can be saved from getting wasted. We should start saving water ourselves. There are various ways through which water can be saved from getting wasted.

The water level monitoring systems can be simply divided into two types:

1. Simple Methods
2. Advanced Methods

2. SIMPLE METHODS

2.1 Alarm System Using IC555 Timer

In this proposed system the submersible pump is turned OFF and ON according to the water levels. Compared to other conventional methods, the time taken by the control circuit to stop and start the motor when water reaches its predetermined level is about 0.5 sec. This system uses the high and low states of a 555 IC to activate or deactivate the TRIAC.

2.1.1 Merits of this system

1. The automatic water level controller is a reliable controller in terms of system feedback with respect to the non-linearity presented by pumps and sensors.
2. It is cheaper and durable.
3. Excellent performance with its reliable technology.

2.1.2 Demerits of this system

1. Difficulty in getting a constant output voltage from the IC 555, which sometimes alternates at a range of 1.5-2 V as a result the motor doesn't start properly.
2. It is a submissive electrical system and hence requires a constant supply of electricity.

2.2 LED System using Transistor

In this system three wires are used to indicate the different water level of glass through the different colour LED. The base of the three transistors makes contact with the water at three different levels like low, medium, and a high. When the bottom terminal makes contact with the water, the current starts to flow base to the emitter terminal. This flow of current in the emitter terminal allows the LED to glow at different intervals.

2.2.1 Merits of this system

1. This system eliminates seepage of walls and roofs due to overflowing water tanks.
2. Also, consumes very little power, ideal for ongoing operation.

2.2.2 Demerits of this system

1. This system requires manual control & chances of dry running are high.

2. This system does not prevent little wastage of water during ON and OFF time.

2.3 PID Controlled Monitoring System

This proposed system is a PID controlled water pump system in order to monitor and control a desired water level in a storage tank that is used in chemical, industrial & domestic or other related applications. By adjusting the parameters of the PID controller, the motor speed and hence the rate of water flow into the tank is controlled. Step reference water level is set and also step response of the system is set in MATLAB software in order to reduce the overshoot, improve the settling time (improved transient response) and with that system's steady state error.

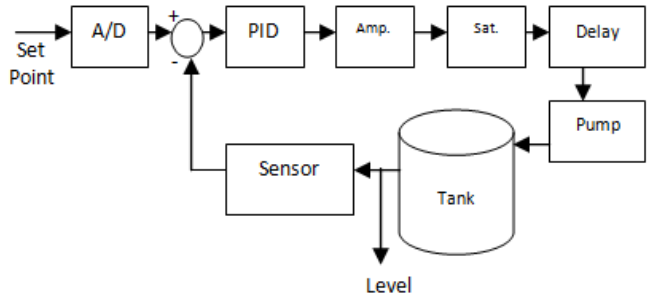

Fig -1: Block Diagram for PID controlled monitoring system

2.3.1 Merits of this system

1. Compared to P, PI & PD, PID controller achieves super performance. It is shown that suitable values for Kp, Ki, Kd parameters can be found.

2. PID controllers are powerful in monitoring (tight control) of the process variables or parameters that have significant impact on quality.

2.3.2 Demerits of this system

1. The integral term in the PID controller eliminates the steady state error but due to this reason the system stability also gets affected.

2. PID is a computer based system, if the parameters are taken incorrectly then input of the control process is unstable.

3. ADVANCED METHODS

3.1 Monitoring System using IoT

One of the modern methods of monitoring water levels is based on the Internet of Things. Herein the data from the sensor is transmitted to the cloud platform through a wireless gateway. Then the data is being displayed by the cloud on the user's remote dashboard which can be accessed on the mobile or computer. On the data displayed, the user can monitor the devices accordingly. Moreover we can say it's like operating things on our terms and needs from anywhere.

3.1.1 Merits of this system

1. Accuracy of the data as the readings are obtained for every 20 minutes.

2. Data displayed in graph format and indicated in centimeters.

3. Controlled by the user remotely.

3.1.2 Demerits of this system

1. Stills needs manual control from the user.

2. Internet stability and connection to the cloud required all the time.

3.2 IoT based Monitoring System using Laser Sensor

This proposed system for water level monitoring comes under the sphere of Internet of Things (IoT). The main objective of this system is to design an approximating water level system within the tank and forestall overflow or analyse the water usage. This analysing feature also helps to find out whether there's any leakage within the tank or not. In this system the microcontroller communicates with NodeMCU with the help of SPI communication.

3.2.1 Merits of this system

1. It is fast and can measure up to a distance of 2 meters.

3.2.2 Demerits of this system

1. The system becomes quite expensive as laser is used in order to procure proper results.

3.3 Monitoring System using GSM Module

In this method the water level is monitored by storing the data acquired through the sensors to the system's memory and then collected in a database through GSM Modem and displaying it on a mobile application. This system provides

warning regarding the overflow of water. Then the user can turn off the system from the provided mobile application when he wants. Thus it can be said that this method is a great blend of hardware and software architecture for interfacing purposes. Furthermore it is accessible from anywhere which would be a great thing in this modern technology world.

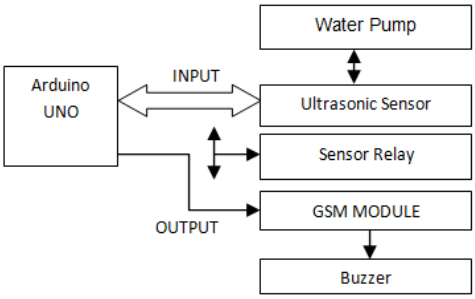

Fig -2: Block Diagram for monitoring system using GSM model

3.3.1 Merits of this system

1. Easily accessible.

2. Data available in Database of system.

3.3.2 Demerits of this system

1. Data transmitted by the sensor might be inaccurate.

2. Turning off the alarm is controlled by the user which might cause disturbance to others if not done immediately.

3. Automated voice calls may disturb the user too.

3.4 Monitoring Using Fuzzy Logic System

The water level in the tanks is managed by a fuzzy inference method that is implemented using a Fuzzy Logic Controller block in this proposed scheme. In this system, the water that flows into the tank is controlled by the user using a valve. The diameter of the output pipe which is constant and the pressure in the tank is dependent upon outflow rate, which varies with water level. Therefore, the system has nonlinear characteristics. In this system two inputs are defined for the fuzzy controller. One is the level of the liquid in the tank "level" and another is rate of change of liquid in the tank denoted as "rate". Both these inputs are applied to the rule based editor. Based on the rules written in the rule based editor the control takes the action and monitors the opening of the valve i.e. output of the controller and it is denoted as “valve”. In this system membership function editor is also used.

There are five rules in a fuzzy system. Based on only the water level error, the first three rules adjust the valve.

A. If the water level is all right, then do not change the valve.

B. If the level of water is low, then open the valve quickly.

C. If the water level is high, then rapidly shut the valve.

If the water level is above the set point, the other two rules modify the valve depending on the rate of change of the water level.

A. If the level of water is okay and rising, then slowly close the valve.

B. If the amount of water is okay and decreasing, open the valve slowly.

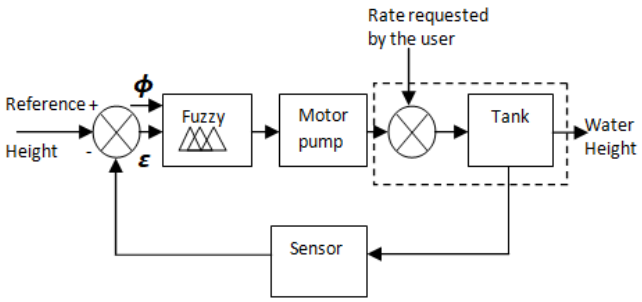

Fig -3: Block Diagram for monitoring system using Fuzzy Logic

3.4.1 Merits of this system

1. Computation is easy and the system has a convenient user interface.

2. The proposed system has a scalable and intuitive knowledge-based architecture.

3. In a situation where the feedback sensor stops working, it can be programmed.

3.4.2 Demerits of this system

1. Fuzzy logic is not always exact, because on the basis of inference, the results are interpreted, so it may not be universally accepted.

2. Setting precise, fuzzy rules and functions for membership is a challenging job.

3. Validation and evaluation of a fuzzy system based on expertise requires rigorous hardware testing.

4. CONCLUSIONS

Water level and quality are critical for many applications, including chemical, household, pharmaceutical, nuclear, etc. This paper basically gives a brief literature review on different technologies and how it can be used in the water monitoring system.

The main objective of all these different systems is to build a model which would require minimal involvement of human beings.

By installing such devices in the control environment it will in return help the environment to be self-protected (i.e. smart environment). In order to enforce this it is important to deploy sensor devices for data collection and analysis in the environment. Thus it can communicate with other objects through the network, by installing sensor devices in the environment. Then through different mechanisms, the data is collected and analysis findings will be accessible to the end user.

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