Enhancing Dam Safety with Sensor Technology: Automated Alerts and Shutter Controls

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ABSTRACT

Dams are constructed to safely control water levels for preservation or emergency situations. By definition, a catastrophe is any event that results in a great deal of unanticipated bad luck that causes a great deal of damage or injury. Dam faults are a clear fit for that description. In this study, it was detailed how the automatic gate control system uses the water pressure to regulate the dam's water flow. The wellbeing of those living close to the dam is preserved based on the alternatives for providing automatic messages. This work made use of a micro controller, alarm circuit, shutter driver, GSM module, water level sensor, DC series motor, comparators, RF transmitter, and receivers.

Keywords: *Micro Controller, Radio Frequency, Electric motors, Alarm Circuit, Water Level Sensor.*

I. Introduction:

The only strategy to preserve the water source is to build the dam. Nowadays, dams are a significant resource for conserving water in addition to other uses. We may use the water that dams store for household and agricultural purposes, as well as to keep people safe from flooding. [3] Spillways are a part of dams' protection mechanism during deformation. The majority of the time, building materials for dams included steel, wood, rock, concrete, and those mixes. However, building materials like soil and other elements are required to construct the dam. Spillways can be constructed with non-erosive materials like concrete and brick. To manage the water flow, a mechanical mechanism was designed for the routine repair or emergency goals.

To prevent floods and preserve water for industrial, agricultural, and power generation uses, a reservoir is required. a device that is integrated into the spillway to regulate the overflow of water at unfavorable times. Control methods were used in conduits along with the dam to discharge water down the tunnel. An external water flow control is required for the gate and its portion of closure in order to achieve a continuous water flow. Various hydraulic hoist mechanisms for controlled watt release. [5] A proper choice for hoisting should be made in order to verify the safety and optimal management of the dam. [4]A setup needed to prepare for the hoist up and to establish a gate. Hoist training often results in unsatisfactory performance. The management of flow process can result in convenience of operation and good economic

maintenance by using the gates & hoist mechanism. As a result, the system that this article implements automatically opens and closes the dam shutter to effectively control the water level in the dam. In order to protect their safety, this system also notifies everyone in the vicinity when the dam opens and closes. (6) It may offer a complete safety network and a database of residents living along the riverbank, resulting in an all-encompassing and effective alarm system.[1]

II. Control Techniques of Proposed System

There have two water level monitors in this suggested system, denoted as Level 1 and Level 2. [2] On the other hand, Level 1 denotes a lower level and Level 2 a greater level. When the water height is less than the indicated value, the control strategy classifies it as Level 1, which signals that the dam shutter should open. When the water height exceeds the indicated value, Level 1 should be noted. Additionally, the surrounding neighborhood receives a warning message. When the water level rises above Level 2, the alarm circuit will sound to notify people. The alert signal is going to be sent simultaneously via radio frequency (RF) to receivers situated along rivers that are downstream. An alarm can be played over the speakers for everyone's safety and to notify those who may be affected by the rising water level. The control unit can signal for the dam's gate to automatically close after the public has been informed. When the dam shutter is in the unlock position and the water level progressively drops during level 1, the dam shutter can be automatically closed. The water levels of the dam are seen in figure 1 as they open and close.

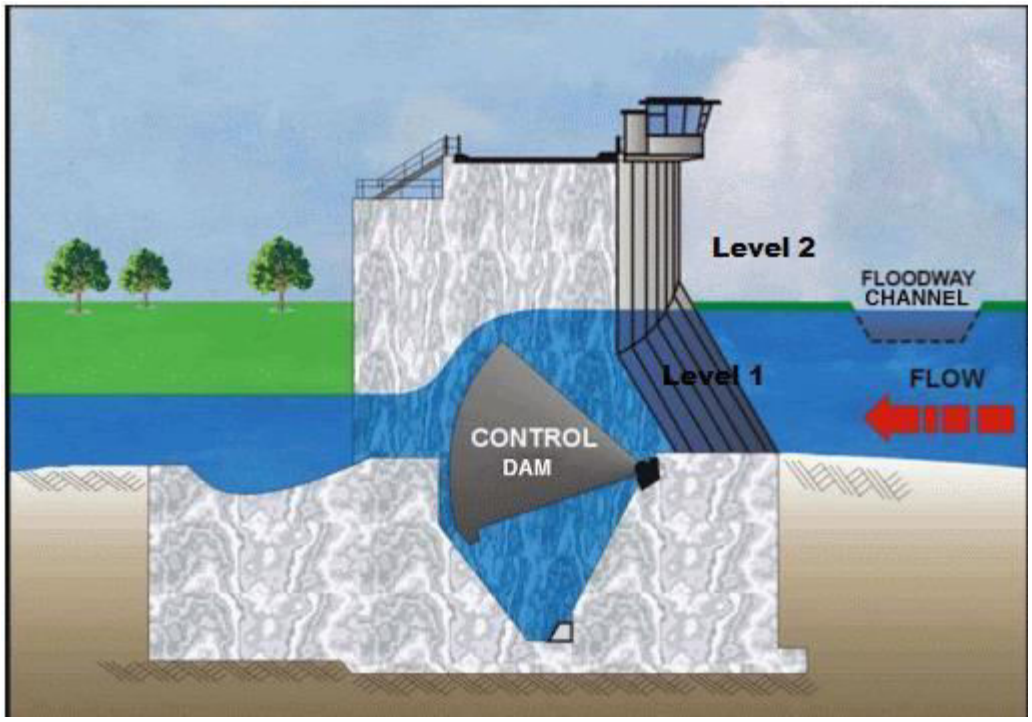

Figure 1:Water Level of the Dam

III. Hardware Description of Proposed System

The suggested system cannot be implemented without the following elements.
Sensors
GSM warning systemRF warning systemGatecontrolsystem

Sensor:

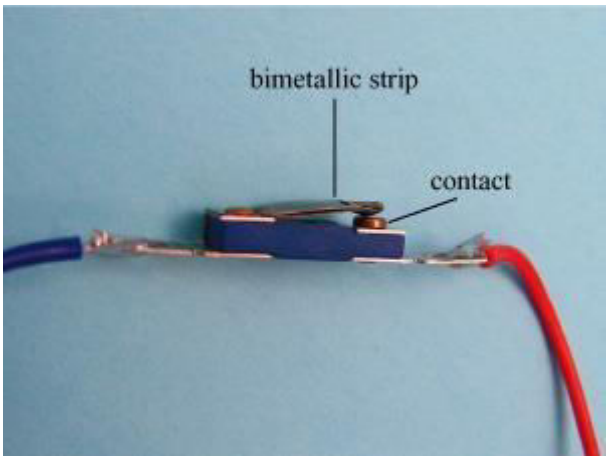

Figure2: Bimetallicstrips for water level sensing

The bimetallic strips used for water level monitoring are seen in figure 2. The sensor is made of two metal strips that are positioned inside of each other and are separated by rubber bushings at the appropriate intervals. The supply is attached to one end of the strip, while the controller is connected to the other. Generally speaking, the electrode can be isolated, so the second end stays zero. The microcontroller senses whether the water level rises to the point when it reaches the strips and conducts. The Level 1 and Level 2 will undergo the same procedure. [1]

GSM based warning system:

When it detects the water level, a SIM card is used to transmit an alarm. We must ensure that all cellular phone number information is gathered and registered to our controller's memory location in order for the caution system to function as intended.

Warning system based on RF wave:

Receiver devices with loud speakers are placed along riverbanks and other locations where people may be in danger if a warning is not given in a timely manner. These include difficult-to-reach places and places where delays in service occur. Feedback is given in advance, leading one to believe that residents need to be compelled to return to healthier places.

Shutter control system

Gateway access is handled by the microcontroller algorithm. Large driving motors are used to release and close the gate once the microcontroller's output is amplified to do so. Electric motors or robust hydraulic systems are used to power the gate. [7]

Algorithm for Automatic dam shutter control:

StepI:Start
Step II: Use the Level 1 and Level 2 water level sensor outputs to determine the water level.
StepIII:If Level 1 is high, the GSM module will transmit a message; otherwise, step II will be repeated.
StepIV:Use the GSM Module to send alert messages.
StepV: When Levels 1 and 2 are high, send an alarm message; otherwise, continue detecting.
StepVI:Send a warning alarm using the RF module.
StepVII:Give the wait time.
StepVIII:The dam shutter is now open.
Step IX: When level 1 is low, dam shutters close, or else the same step
StepX:The Dam Shutter is now closed.
StepXI:GSM module to transmit free alert messages.
StepXII:Again jumptostart

IV. Experimental Hardware Setup

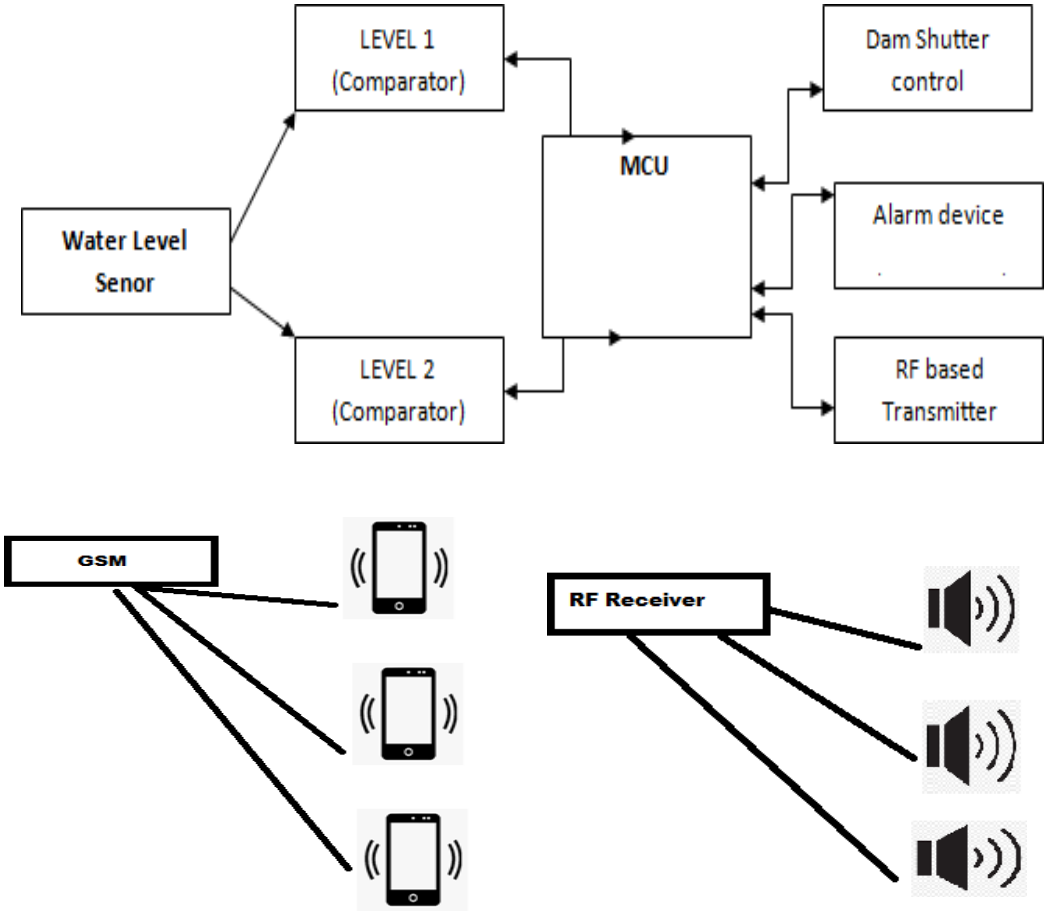

Figure3: Blockdiagramofproposed system

The suggested system's block diagram is seen in figure 3. The dam shutter had been opened and shut depending on the microcontroller's remarks, using a Dc series motor that is connected to the shutters.Residents living close to the dam must get messages from the microprocessor via a GSM module until the shutter is opened. It can detect danger using an RF transmitter as well. The controller uses an alarm circuit to alert the public to the impending dam opening before actually opening the dam. [1]

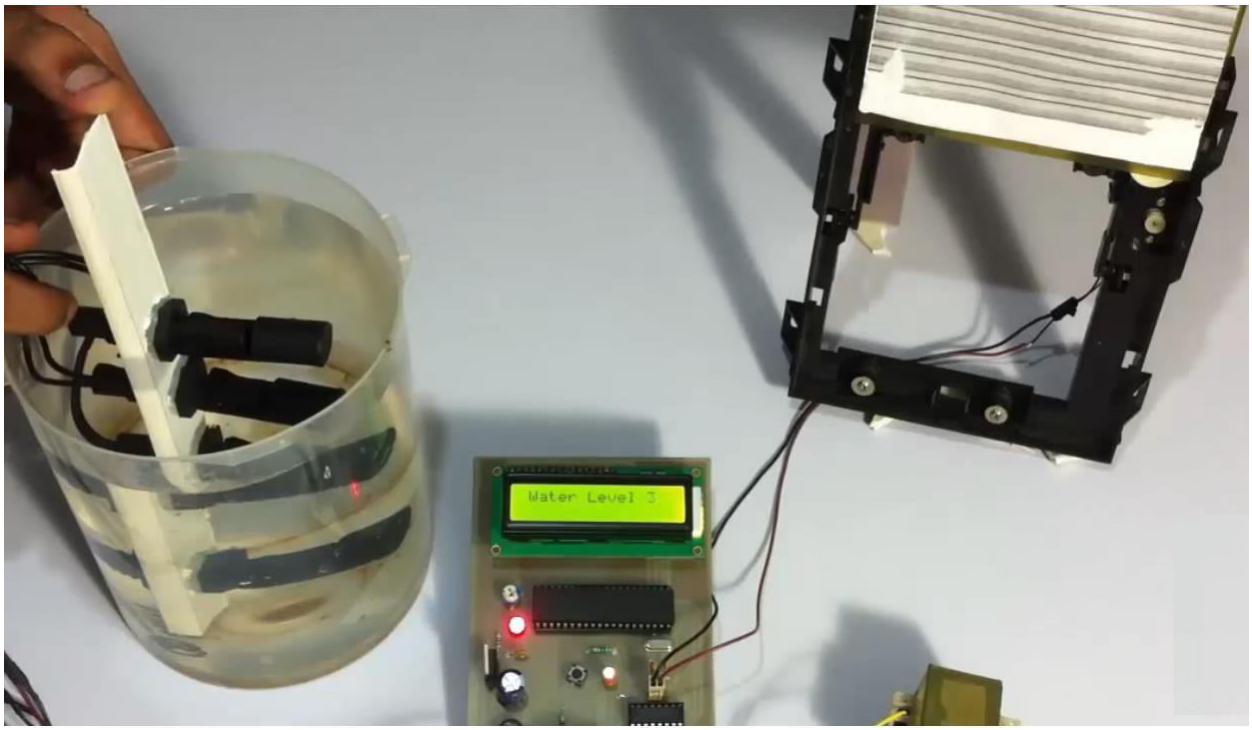

Figure4: Experimental setup of the proposed system

The suggested system's experimental setup is depicted in figure 4. As the water level changes, so does the sensor's output. On the basis of the threshold value obtained from comparator 1 and compared with the sensor's output, a microcontroller is given. Comparator 2 provides a high output to the microcontroller when the water level passes Level 2. This turns on the radio frequency panel, the warning circuit, and the signal which opens the shutter [1]. The comparator will sense when the water level drops below a certain threshold, trigger the shutter's closure via a microcontroller, and alert people to the danger.

V. Conclusion

This research addressed the use of wireless sensors for autonomous control of dam shutters. The research has been accomplished successfully and controls the level of water in a dam by automatically closing and unlocking shutters via the use of a well-designed warning system that guarantees public safety. Experiments have been used to create and validate the prototype and methodology.

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