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# AUTOMATIC ONLINE MONITORING AND CONTROLLING SYSTEM FOR DAM USING ARDUINO

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**Abstract**

Dams are an extremely useful tool for storing water and preserving it so that it may be used most effectively according to the requirements of each season. The mitigation of the existing problems associated with the distribution and use of water requires Water Management to play a very significant role. Because there are a great number of risks associated with the presence of dams, it has turned into an absolute must to devise an efficient monitoring system concerning the opening of the dam gate in order to keep the water level in dams at a safe level. Investigating how the Internet of Things may be used to enhance the safe use of dams, water flow, and the avoidance of dam gate corrosion. The purpose of this study is to employ a microcontroller for the purpose of monitoring and managing the water distribution management. This will be accomplished via the utilization of a variety of sensors and control valves, as well as the automated and proactive management of outflow during times of crisis utilizing statistical data from the surrounding environment.

***Keywords:*** *Control valves, corrosion, IoT, Dam*

## INTRODUCTION

Water management has become an increasingly pressing issue in modern times due to the restricted supply of water that is fit for human use. Natural disasters are caused by unforeseen weather conditions such as heavy rainfall, sudden changes in tides, and other natural forces. These disasters lead to problems such as an increase in the mortality rate, contamination of consumable water, and agricultural problems, all of which have the potential to have a negative impact on the economy of the country. The building of dams results in the creation of new bodies of water for the future, protects the existing water supply from contamination, and eliminates disagreements and excessive use of the resource. As a result, dams play an important part in the process of water management. Dams are an important part of the urban water supply network and play a key role. In addition to this, dams and reservoirs are essential components of a successful agricultural system. Even in modern times, we have continued to manage and monitor the dam gates using the same tried-and-true strategies, as well as measure the amount of water and several other factors. There are a number of things that might lead to the collapse of a dam, the most common of which is overtopping, which is brought on by intense floods. This state requires continual monitoring to prevent disasters such as a dam failure, which is not something that should be taken lightly. The enabling technology known as the Internet of Things (IoT) is applied in order to circumvent dam failure and for the purpose of continuously monitoring dam health. Because of this, the authorities have constant access of data regarding the health of the dam, which enables them to make decisions that are suitable.

## Objective

1. The Study Controlling System For Dam Using Arduino.
2. The study Dams play a prominent source of water supply to the urban networks.

Dams are the primary means by which urban areas receive their drinking water supply; in addition, they are an essential component of flood management and can facilitate river traffic. The majority of dams are designed to fulfil more than one function, which increases the number of ways in which they are beneficial. These water resources that are made available by dams are one of the primary sources that may be used for a variety of purposes, including irrigation, animal production, and industrial use. The method of managing the water behind dams is laborious and time consuming, and it must be upgraded in stages. Establishing a new system for the management and monitoring of dam water is something that needs to be done. This new system should be one that can control dam water by effectively distributing it to draught-based places, monitor the water as it travels through those places in real time, and enable effective usage of dam water by presenting the data of water distribution on a website. Our model depicts the channelling and distribution of dam water to those locations where there is a shortage, and this may be accomplished with the assistance of soil moisture sensors that have been built in those locations and that communicate wirelessly with one another.

If there is a shortage of water in a certain location, we are able to obtain information on the quantity of water that is currently available there and then direct the water supply to that area. The watering process is greatly aided by this. The use of wireless sensor networks alongside water management software contributes to an improvement in the operational capacity of dams. This project provides an outline for the study of draught regions, as well as the construction of an automated and decentralized system to channelize the water in the dam in accordance with the results of the analysis. Additionally, this project will build an information system based on the systems that are already in place, making use of some sensors and IoT. This project also proposes the creation of an automated water dispensing system by making use of the resilient algorithm and Data structure. By doing so, the operation of Dams all across the country may be decentralized and automated.

## RESEARCH METHODOLOGY

In order to monitor the characteristics of the dam, the system employs a variety of sensors of varying sorts. The system may be broken up into two distinct components:

### Automatic Dam Gate Control

The devised method automatically regulates the dam gate by installing water level sensors at various phases of the reservoir. This allows for more accurate readings. After the dam gate has been opened, a flow sensor is used to calculate the amount of water flowing out of the dam. This allows for more efficient water management and utilization. By utilizing the turbidity sensor, an accurate measurement of the water's turbidity may be obtained, which, in turn, helps to keep dams from being clogged with debris.

### Corrosion Detection

In order to determine the level of corrosion on dam gates, an external anode and cathode connection is made, and the resulting current is then measured. Ion metres and other ion sensitive elements are attached to the dam gates, which are made of metal, because metallic things are the best conductors of ions. Because of this, the corrosion of the dam gates is monitored using these methods, and the information that is acquired is sent. On the basis of this knowledge, the preventative step of epoxy coating may be carried out in order to preserve the gates of the dam in excellent condition.

## SYSTEM DESIGN

The following is a list of the hardware requirements for the system that is being proposed:

### Flow Sensor:

The flow sensor is utilized in order to measure the amount of water that is released from the dam. It has a plastic valve body, a rotor, and a hall sensor as its components. When water runs through the rotor, it rotates, and the rotor's speed may be adjusted to accommodate varying flow rates. The value of the matching pulse that is sent by the Hall Effect sensor is the output. The flow may be determined by applying the appropriate formula.

### Turbidity Sensor:

The turbidity sensor makes use of the idea of optics in order to determine the level of turbidity present in the water. Calculations of the transmittance and scattering rate of the water are carried out with the assistance of an infrared tube. The output is determined by the matching voltage value, and it has an inverse relationship to the amount of turbidity in the water.

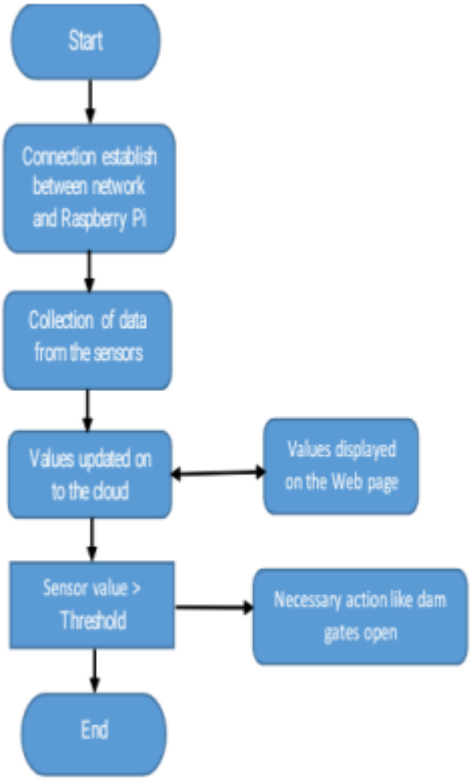

**Fig. 1 Flow Chart Of The Proposed System**

**Developed monitoring dam system**

The monitoring dam system develops a mechatronics-based system, which detects the water level inside the dam, as well as the water stream level before and after the dam, and as a result, it automatically and in real time controls the movement of the gates, offering flexibility. This system is made up of a collection of sensors such as water level sensors that are connected to Arduino through the use of electrical wires. Additionally, this system is capable of connecting to the pressure sensitive Arduino through the use of wired electrical connections and wireless inputs from flood early warning systems located before and after dams, which send information regarding the stream flow level and intensity. The output from Arduino is wired to an LCD display, which shows both the water level and the pressure. Additionally, Arduino is wired to a DC motor through a ULN driver, which allows the user to control when the dam gate is open or closed. The ULN driver, which in turn controls the operation of the stepper motor by turning it on and off and moving it in either a clockwise or anticlockwise direction, is responsible for the stepper motor's functioning. The link to the system depicted in Figure 3 and Figure 4.

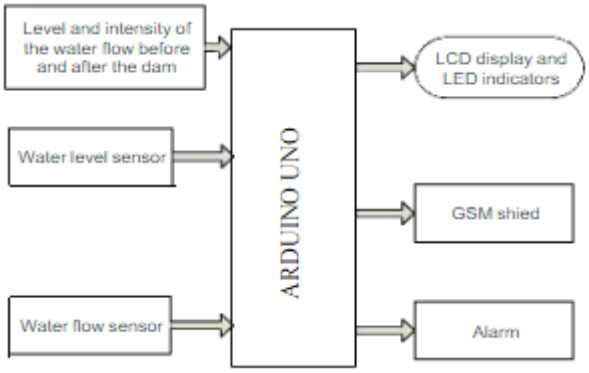


**Figure 2. Block Diagram Of Flood Early Warning System of Najran Dam**

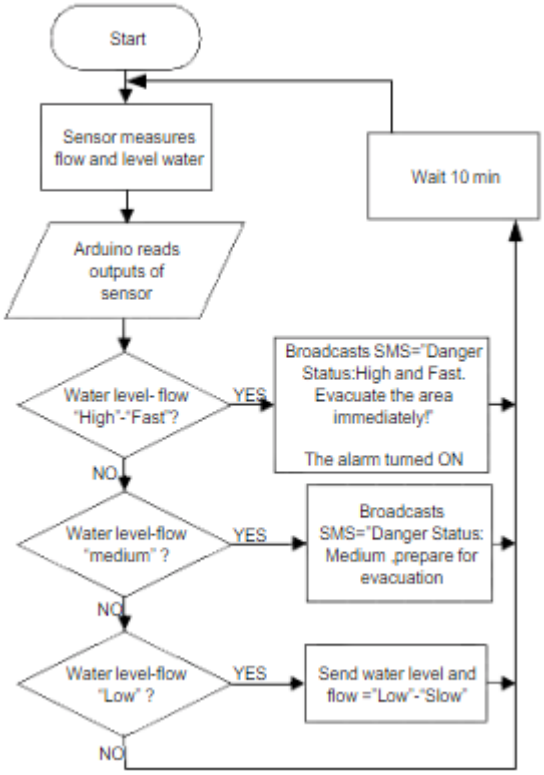


**Figure 3. Flowchart Of Flood Early Warning System Of Najran Dam System**

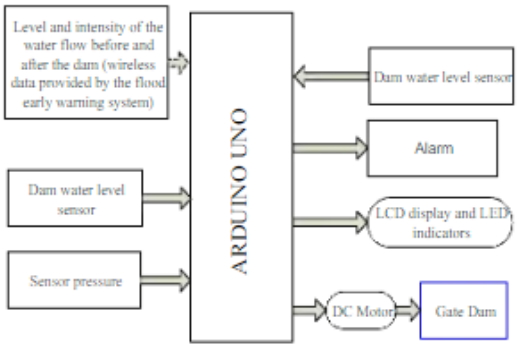


**Figure 4. Block Diagram Of Developed Monitoring System Of Najran Dam**

## DATA ANALYSIS

The purpose of this section of the report is to document and verify that all of the outcomes produced from the simulations fulfil the prerequisites and goals of the current endeavor. In this part, the analysis of findings is covered, which will prove to be extremely valuable when deciding the process of optimizing and reviewing this strategy to make sure it can be used effectively. An additional experiment was carried out to validate the flood early warning system. This system is responsible for providing the monitoring system with an input message that contains the water level signal.

The outcomes of the experiment that was carried out are discussed in this section. The model system of the created system structure was validated through the use of an experiment that controlled the influence of high

water. The experiment's results are displayed in the illustration of the monitoring dam prototype. Both the architecture of the system and the prototype system have undergone advanced design. The standard configuration of the system includes the following components: an aquarium tank of moderate size, a water sensor, a water pressure sensor, a DC stepper motor, an Arduino UNO R3, and a GSM Shied. The system under consideration was put together, examined, and validated. The test prototype monitoring system that is based on flood early warning system has been explored with virtually every imaginable circumstance, and some very encouraging findings have been found out. Experimenting with control is one way to validate the model system that was suggested. The scale in the laboratory is used to measure the height of the water. The pressure sensor that is attached to the dam barrier is responsible for measuring the water pressure on the dam barrier as well. in accordance with Tables 1 and 2, as well as by the execution of an experiment using the newly built system. The circumstances stated in the will serve as the basis for determining the processes for opening and closing the dam gate.

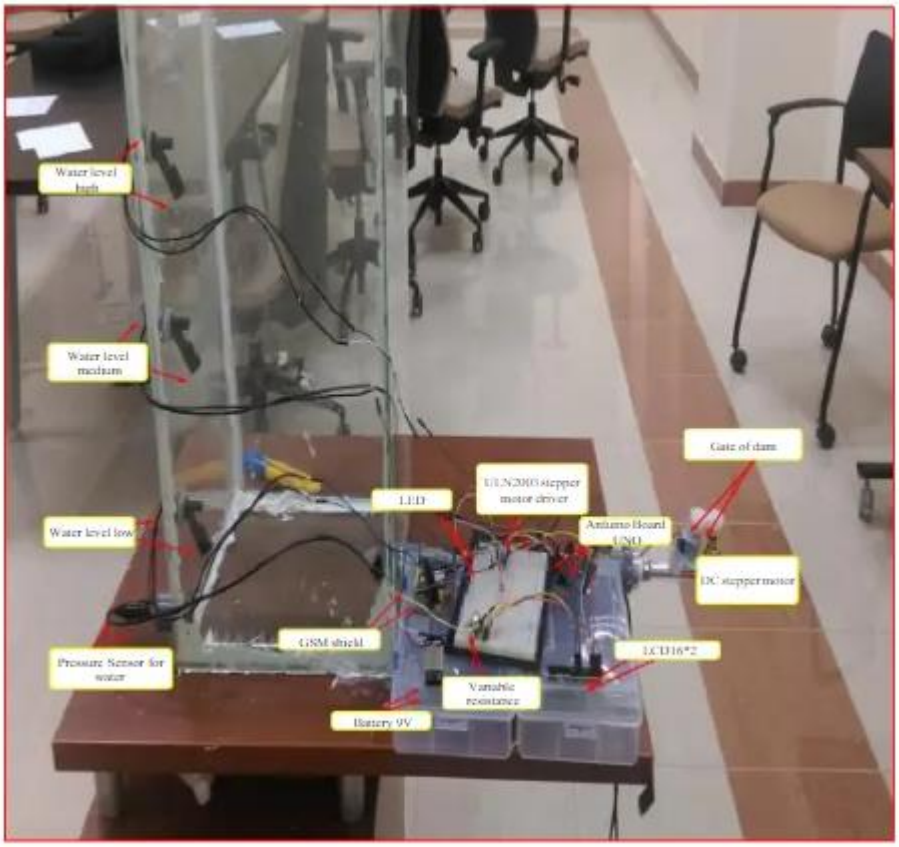


**Figure 5. Experimental Setup of Dam Monitoring System**

The level sensor is monitoring the water level, and when it detects that water has reached the sensor, it indicates that there is insufficient water in the dam. The LED illumination is green and the LCD panel reads "water level low"; also, the dam gate is closed. A level sensor is used to determine the height of the water, and when the water reaches a sensor, it indicates that the level is medium. The LED lights in blue, the LCD display reading "water level medium," and the level DC stepper motor all work together to open the gate to the half dam. The level sensor monitors the water level and sends an alert when the water reaches the sensor to indicate

that the water level has reached a high point. The red LED illumination, the LCD monitor that reads "water level high," and the level DC stepper motor all work together to open the complete gate on the dam. The alarm was activated at that point to indicate that the water level in the dam had reached its maximum capacity.

The gate is also controlled by the flood warning system, which receives a message from the flood early warning system that contains information on the amount of water in the flood stream. In order to prevent the stream from becoming flooded, the system adjusts the dam gate so that it is only partially open rather than fully open when the water level is high. The mechanism will open the dam gate if the received message is of a low priority. The early flood warning system and the monitoring dam system are working together with the goal of draining the water from the dam and absorbing the water that is flowing from the surrounding mountains and valleys. In addition, the system is able to monitor the water pressure at the barrier of the dam, which not only provides information regarding the water pressure on the dam but also allows the operator to anticipate any potential dangers that may arise in the future. According to the findings, the system is already stable in terms of precisely recording the water level, managing the dam gate, and measuring water pressure. Additionally, the system can also measure water pressure. Because it can easily release the dam's water while preserving the structure's integrity, the system can be relied on to perform as expected. In order to automate the process of operating the dam gates, a DC motor that is controlled by Arduino was used. Arduino did this by comparing the inputs, which consisted of the level signal at the interior of the dam to the level signal at the water stream before and after the dam. This level signal was collected from the water level sensors that were positioned at the water steam that was located far away from the dam. LED and LCD monitors provide all information continuously on the dam and the water level flood. A comparison with previously published research in shown that utilizing the Arduino is beneficial to this system, as evidenced by the results of the comparison.

On the other hand, the results given in were achieved with a PIC microcontroller and a computer. This indicates that the suggested system is efficient in terms of cost and provides a straightforward method of programming and putting it into action in the actual world. Within the scope of this study, a prototype for the monitoring system of the Najran city dam was conceived, constructed, and validated using downscaling techniques. This prototype is being done primarily for the aim of validating the suggested design technique for the real product. In addition, the production of prototypes is frequently a process that is both more immediate and less expensive. As a consequence of this, it has enabled designers to give stakeholders with accurate and usable models before agreeing on a specific design. When determining how to enhance the suggested design while staying within the allotted time and financial constraints, this phase needs to be taken into consideration.

## CONCLUSION

The water level inside the dam, as well as the water level before and after the dam, as well as control of the Najran dam gate, have all been successfully measured, and the gate of the Najran dam has been successfully controlled. In order to accomplish the fourth purpose, all of the dam's data is shown on an LCD. The findings demonstrated that the newly created system is operational with a hundred percent rate of success. It has been demonstrated that the water sensor can provide accurate readings of the water level. Additionally, the capability of the stepper motor to regulate the dam gate, and the capability of the pressure sensor to monitor water pressure. It has been determined that the produced system will assist to take quick action to save lives and minimize damage caused by the flood catastrophe. This was determined after coming to the conclusion

that the developed system will ensure the effective water drainage system. With Determine the amount of water in the dam as well as the water stream both before and after the dam, and make sure that the gate of the dam can be fully controlled without any interference from a person; this will assist guarantee that water is discharged effectively. In addition, the water level monitoring procedure may be automated by installing a sensitive water pressure sensor on the dam. This makes it possible for the professional management that can be adopted from the flood early warning system to be put into effect before, during, and after the rain and flood. In conclusion, we validate a new approach to discharge the water from the dam in a manner that avoids causing any harm, whether to people or to property.

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