Dam Gates Management System using IOT

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Abstract

Dams play a very important role to hold and conserve water for optimal usage based on seasonal needs. Water Management plays a very important role in mitigating the current issues of water distribution and utilization. As there are lot of hazards related with the existence of the dams, it has become a necessity to develop a proper monitoring system regarding the opening of the dam gate to retain a safe water level in dams. Exploring usage of IoT for improving the safe utilization of dams, water flow and prevention of dam gate corrosion. This paper intends to use microcontroller for monitoring and controlling the water distribution management by usage of various sensors, control valves, automatically & proactively manage outflow during crisis by using statistical data of the environment.

Keywords: Dams, water management, IoT.

1. Introduction

Nowadays Water management is an issue of growing concern, as there is limited availability of consumable water. Owing to unforeseen weather conditions such as heavy rainfall, sudden change of tides and other natural forces leads to natural calamities which causes problems like increase in mortality rate, contamination of consumable water, agricultural problems which may negatively impact the economy of the country. Construction of dams provides water bodies for future, protect the available water from pollution, prevents disputes and over exploitation. Therefore, dams play significant role in water management.

Dams play a prominent source of water supply to the urban networks. Apart from this, dams and reservoirs play an important role in agricultural system. Even today we have been using traditional methods for managing and monitoring the dam gates and measuring the level of water and other parameters. Many factors contribute towards the failure of a dam, the most common being Overtopping which is caused due to heavy floods. This condition needs constant monitoring to avoid catastrophes such as Dam Failure, which is not to overcome the Dam Failure and for the continuous monitoring of Dam Health, the enabling technology of Internet of Things (IoT) is used. Through this the authorities have continuous availability of data about the dam health and they can take appropriate decisions.

Many systems were available for monitoring of dams. Few notable ones related to our research are

1. are paying attention towards the development of autonomous dam gates system using level sensors and motor controller. Although the dam gates are automatically controlled using DC motor but no information is provided regarding the water level.

2. have developed a system where the controlling of dam gates is done through the data collected with the help water level sensors deployed near the dam area. This idea will help us to efficiently control the dams all over the country by reducing the manpower for maintenance of the dam. A set of sensors are used to gather information regarding the level of water and then sends instructions back in order to control the dam.

3. have proposed a system which has the ability to notify the present status of the dam and also alerts when the dam conditions have changed from the normal conditions.

4. have proposed a concept where the system checks for cracks in walls, increased levels of turbidity in the downstream, which could be a manifestation dam, pipe detoriations and corrosion on the gates of the dam. This obtained information can be displayed in an android application for further decision making by the authorities.

[5], are paying attention Wireless Sensor Network, Android application and ZigBee technology for early flood warning. The sensor network will send details about the water level to the server through ZigBee communication. ZigBee is connected to dam and main server. The concept also implements the safe zone notification. User can fetch safe zone live mapping with without internet

A dam could be a massive barrier built for the protection of a vicinity from water overflows still as to be used for other reasons like land irrigation and hydroelectricity generation [5]. Inarguably all countries within the world today have dams [7]. However, a really few treat automated systems, which are more practical and efficient than manual ones [6]. Hence, it'd be useful for all countries to begin to use automatic systems for his or her dams as this can reduce the quantity of effort that they're already putting towards dam maintenance and water outflow [8].

Water level in a dam needs to be maintained effectively to avoid complications. This is generally performed manually which requires full time supervision by a greater number of operators. Moreover, the quantity of water released is hardly ever correct resulting in wastage of water & it is impossible for a man to precisely control the gates without the knowledge of exact water level and water inflow rate. This system consists of a level sensor connected through Arduino. The water level will be analyzed using these sensors and updated in the web server using IOT module connected to the Arduino. Authorities can view this information using internet from any place and also, they can make a decision to control the dam gate to avoid further complications.

The cradle of our project is based on methodology of IOT. Water level in a dam needs to be maintained effectively to avoid complications. The quantity of water released is hardly ever correct resulting in wastage of water & it is impossible for a man to precisely control the gates without knowledge of exact water level and water inflow rate. We have designed a system in which real time things are interconnected to web. Water level sensors are placed in dam to serve the same purpose automatically and forward the status to Arduino. Arduino unit checks that input and upload the status of water level on web. By this project each and every variation of water level is informed to control room through the internet (using blynk application) and nearby people can be informed in time thus saving lots of lives and avoiding the unpleasant scenarios.

2. Literature survey

Now-a-days water scarcity has become a heavy problem in India and there are many factors accountable for this like improper supply of water from the dam, improper water saving systems, etc.,[3].

But one major factor is that the improper opening and shutting of the dam gate consistent with the extent of water within the dam. Also, till date the control mechanism of the dam gates is completed manually. But there are plenty of risk factors that are related to manual method [4].

In uncertain times like when there are floods or heavy rainfalls because of climate changes suddenly, it becomes difficult to open or close the gates manually [2].

So, we want an automation system to regulate the dam gates in these difficult times based on water level [10]. Manually doing it should take lots of your time and is additionally not safe. So, in an automatic system we are able to alert the people within the surroundings by buzzer sound and send an alert message to the higher authorities and people nearby to take further precautions and transparent to public [1]. By using Ultrasonic Sensor Crack identification will also become easy [9].

Various efforts have been made uptill now in monitoring water level & accordingly controlling dam gate. The contribution of work in this area is mentioned below

1. IOT based water supply monitoring and controlling system: Water is a basic need of every human being. Everyone needs to save the water. Many times with lack of monitoring,overflow of the water takes place. Overflow of tanks can occur because of this lots of water wasted. Another thing is because of overflow in the pipelines with more pressure there is possibility of pipeline damage. Leakage detection is one more problem. All these problems are because of lack of monitoring, manual work and less man power. In this paper a survey of Aurangabad city and field survey have been done, to understand water supply distribution and related problems with the system. After taking a survey they observed that all the work is manual and need a better technology to make proper distribution. [1]

2. Automatic Gate Control and Water Level Reservoir using GSM technology: A dam is a barrier that arrests water. Dam serve the purpose of storing water while other structures such as floodgates are to prevent water flow into specific land regions. The dam gate collapse when the water level in the dam exceeds certain level. To avoid this, dam level must be continuously monitored. Water is a scarce resource; it is necessary to preserve and maintain its quality. The water related parameters should be under constant check and evaluation. The main water pollution related parameters such as temperature and pH are to be monitored. In this paper they have used the PIC16F877A Micro Controller which helps in continuously monitoring the water level in dam & also helps in indicating about flood.[2]

3. Wireless Disaster Monitoring and Management System for Dams: This paper suggests architecture to control gate by monitoring high density and then communicate in real time. Considering the recent events that took place on June 2013, a destructible situation has taken place due to heavy rainfall and cloud bursting at various places. Many dams were out of knowledge on various parameters about the flow and discharge from the nearer dams which were affected earlier and due to lack of communication among these dams, lead to considerable damage of property and life.[3]

4. Dam gate level monitoring and control: The main objective of this paper is to control the water Level in dam which was implemented using IOT (Internet of Things). The design implementation and control of the programmed monitoring system was developed by this project. The cradle of the project is based on methodology of IOT. For best results, the principal operation of the automatic gate control arrangement is subjected to dry running under various possible circumstances, with Proteus as the platform for working.[4]

5. Arduino Based Automatic Dam Monitoring and Alert System: This paper deals with the automatic control of a dam river system. The system is a cascade of single input-single output (SISO) systems, and can be considered as a single input-multiple output (SIMO) system, since there are multiple outputs given by intermediate measurement points distributed along the river. A generic robust design synthesis based on internal

model controller (IMC) design is developed for internal model-based controllers. The robustness is estimated with the use of a bound on multiplicative uncertainty taking into account the model errors, due to the nonlinear dynamics of the system. Simulations are carried out on a nonlinear model of the river. The industry has always focused to devise engineering methodologies for establishment and modification of relatively easier controlling and automation methods for any scrupulous process.

6. IOT Based Water Level Monitoring System for Lake: In this paper they have introduced the idea of water level monitoring and management for lake water storage source for villages. More specifically, they have introduced the raspberry- pi as controller for water level sensing and controlling in a wired and wireless environment. Furthermore, it can indicate the amount of available water in the lake. This system is based on GSM technology. Moreover, cellular phones with relative high computation power and high -quality graphical user interface became available recently. From the user's perspective it is required to reuse such valuable resource in a mobile application. Finally, paper has proposed a web and cellular based monitoring service protocol for monitoring available water in lake.[6]

3. Proposed system

The developed system controls the dam gate automatically by deploying the water level sensors at various stages of the reservoir. Once the dam gate is open the outflow of the water is calculated by employing flow sensor which leads to effective management and utilization of water. Turbidity of water is effectively measured by deploying the turbidity sensor which in-turn prevents the sedimentation caused in the dams. The corrosion of dam gates is measured by connecting anode and cathode externally and current generated is measured. Since the dam gates are constructed using metal, the ion sensitive element or ion meters are placed on the metallic objects. Hence corrosion of the dam gates is monitored using these methods and the gathered information is conveyed. Based on this information the counter measure of epoxy coating can be done to maintain the good health of the dam gates.
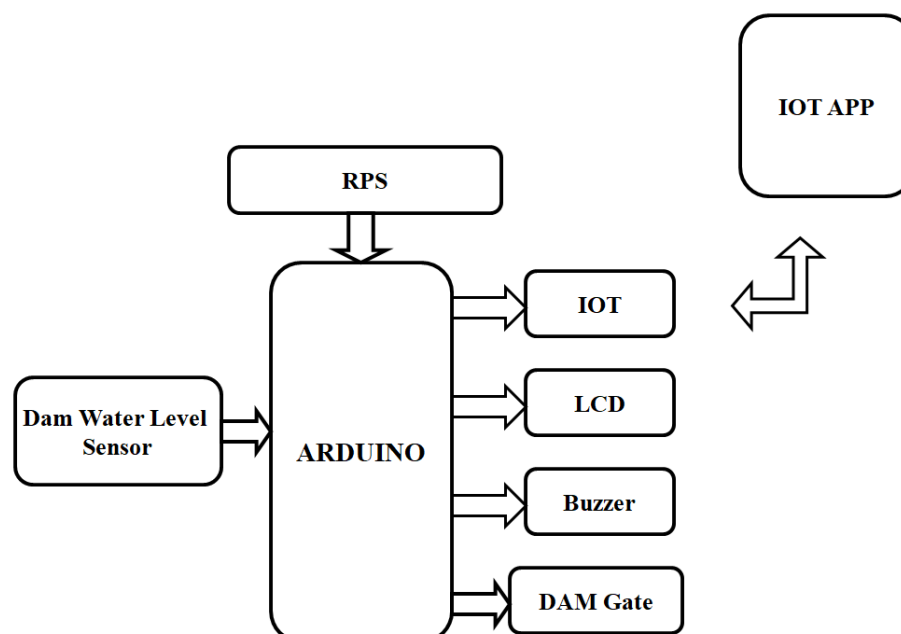

Fig. 1: Block diagram of proposed system.

Here we have made the system by using Arduino over IOT. At the first stage of design a water level sensor is used for sensing water level accurately. Raspberry-pi is used to control the overall system automatically that reduces the design of system and control complexity. Arduino takes input from the sensor unit which senses the water level through level sensors. When water level rises or decreases then the sensor circuit triggers the Arduino. We have designed the extra power supply for DC motor & buzzer. To drive the DC motor the driver IC(L293D) has been used. To drive DC motor large amount of current is required. Using Arduino, we don't get the sufficient amount of current to drive the DC motor. Driver IC increases the current and drive the DC motor.

3.1 Arduino IDE

What is Arduino IDE?

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

A program for Arduino hardware may be written in any programming language with compilers that produce binary machine code for the target processor. Atmel provides a development environment for their 8-bit AVR and 32-bit ARM Cortex-M based microcontrollers: AVR Studio (older) and Atmel Studio (newer).
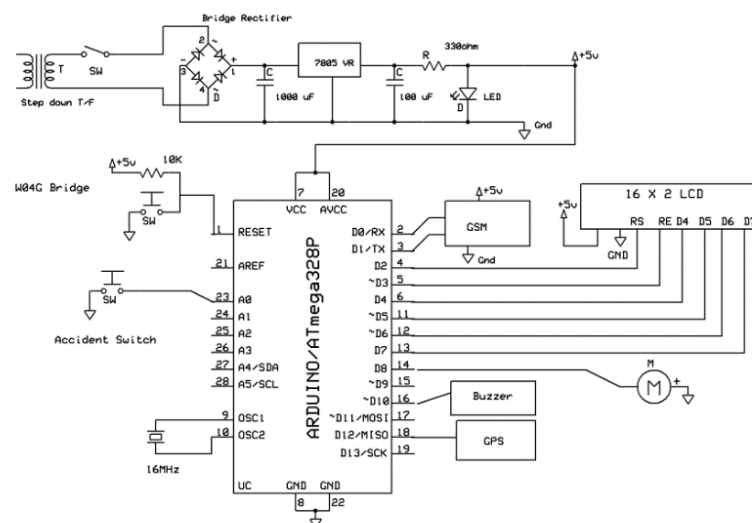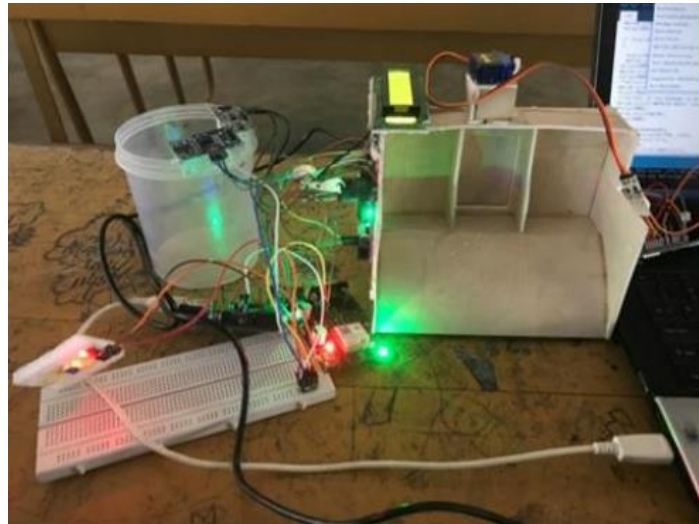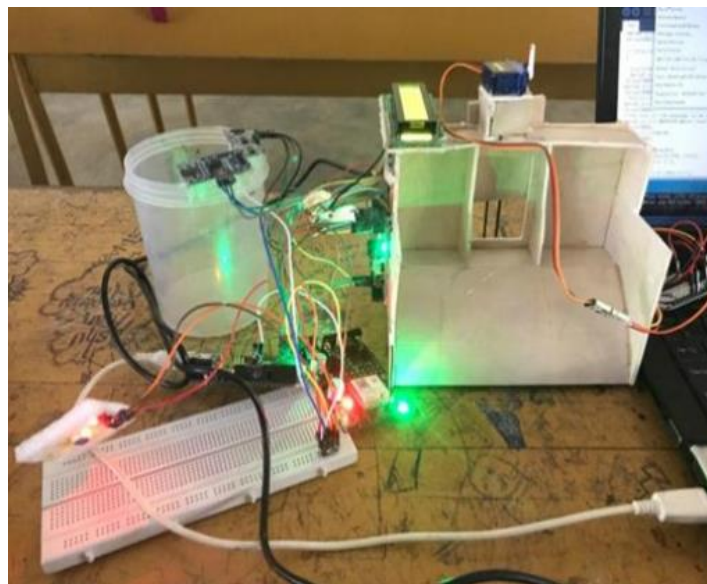
3.2 Schematic diagram

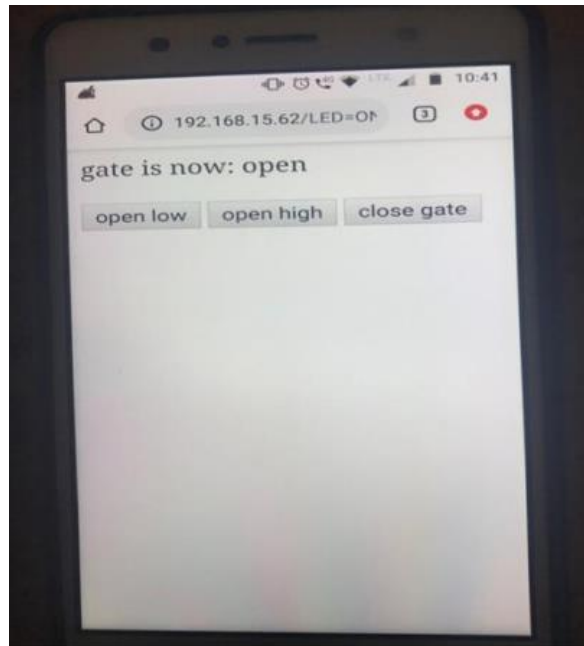Fig. 2: Schematic diagram of proposed system.

4. Results

Dam gate in closed state

Dam gate in fully open state

Dam gate control on mobile- dam in open state

5. Conclusion

The proposed automatic dam gate control system reduces the water wastage and automatic opening of dam gates is possible based on the water level present in the dam. There is not much requirement of human laborer's for monitoring the level, just one operator is sufficient. Operation execution time is less. Automatic opening of gates based on the water level reduces the man-made mistakes and involves fewer human efforts. Gives proper alert for the authorities and the people nearby. The crack identification also helps in preventing the dam failure.

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