Automatic Dam Gate Control System Using Raspberry Pi

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Abstract- *Water level in a dam needs to be maintained effectively to avoid complication. This is generally performed manually which requires full time supervision by the operators & have fairly large staff complements. 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.*

Themain objective of this project is to develop a mechatronics based system, which will detect the level of water and estimate the water inflow rate in a dam and thereby control the movement of gates automatically in a real-time basis which offers more flexibility.This project is a Raspberry pi BCM2835 based dam gate control system which helps inkeeping an eye on the frequent usage of water resources from dam for irrigation purposes and efficient operation of dam gate according to the level of water and also helps in indicating about flood to people living in the surrounding. This proposed mechanism of dam gate control reduces the water wastage and efficient usage of available water is ensured. Also there are heavy load shedding problems in the villages in almost all states of India. To overcome these problems the proposed dam gate control system can be combined with the operation of the geothermal and nuclear power plants for generation of electricity.

Keywords- Raspberry pi, GSM module, Motor driver, Buzzer.

I. INTRODUCTION

Now-a-days saving of water and the security of people who are living near the dam has become a major issue in India and there are many factors responsible for this like improper supply of water from the dam, improper water saving systems etc. But one major factor is the improper opening and closing of the dam gate according to the level of water in the dam. The wastage of water in dam system is more. We work on this topics to reducing the wastage of water by controlling the dam gate using raspberry pi and using GSM system safe them. Earlier days the dam gate open or close by manually and these are time consuming process. When dam are manually open or close the more wastages of water in this manual process. The manual process is very poor secure system .In this system need a 24hr observation on the dam gate and water level. This system need more man power. This is the limitation of this manual dam gate control system.

The main objective of this project is to develop amechatronics based system, which will detect the level of water and estimate the water inflow rate in a dam andthereby control the movement of gates automatically in a real-time basis which offers more flexibility. This system consists of a set of sensors connected to a stepper motor through an 8-bit microcontroller. This microcontroller operates the H-Bridge which controls the operation of the DC motor i.e. switches on the DC motor moving it in a clock wise direction. The water level and rate of inflow is detected based on the feedback from the sensors used. Based on this data, the level of dam gate can be automatically controlled using a DC motor.The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi has a Broadcom BCM2835 system on a chip which includes an ARM1176JZF 700 MHz processor Video Core IV GPU and was originally shipped with 256 megabytes of RAM, later Upgraded to 512 MB. It does not include a built in hard disk or solid-state drive, but Uses an SD card for booting and long-term storage. This project uses regulated 5V, 1A & 7805 three terminal voltage regulators are used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer. Water level in a dam needs to be maintained effectively to avoid complications. This is generally performed manually which requires full time supervision by the operators & have fairly large staff complements. 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.

Now days in electronics field we need compact circuitry and small size the PLC based system is huge and the controller system need a PC then this is large circuitry then we are proposed new technology control the dam gate using raspberry pi. This is mechatronic based system. When we use the raspberry pi then no need to use the CPU of computer, then the circuitry are very small. Raspberry pi is working as a small computer.

Raspberry Pi can also design in conjunction with GSM so as to we can achieve the important feature i.e. security for our system.

II. LITERATURE SURVEY

The proposed system is mainly concerned with the real time operation of dam gates depending on the level of water. But there are many other parameters that have to be considered when this system is implemented in real.

In [1] X. Litric, proposed an irrigation based system AT89S51 microcontroller is used in this system. This system control the dam gate properly and indicate the water level But this system are not used for large system this only use for small irrigation system. Main limitation of this is not used the GSM module for indication of the flood. This is the limitation of the SIMO system.

This paper deals with the automatic control of a dam river system, where the action variable is the upstream discharge and the controlled variable the downstream discharge. 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.

In [2] S.S.Mohani, S.M.U.Talha, S. H. Ahmed and M. Ebrahim they are proposed PC based automated system, the industry has always focused to devise engineering methodologies for establishment and modification of relativel easier Controlling and Automation methods for any scrupulous process. This paper presents the design and implementation of a control system by means of microcomputers and data transmission networks. To verify the principle operation of the Controlling design to be presented a miniature Automated Dam model is experimentally tested using a PC-based system replicas of the automated system have been used successfully in other places for 18 months. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated area.

In [4] [5] J. Guo , Q. Chen they are proposed the PLC based system, It is a huge system then its suitable for the large system its cost is high .This is the limitations of PLC based system.

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The system we proposed can be merged with the mentioned system for effective operation of dam gates. In our system the sensed data is only the level of water in dam.So the upstream and downstream flow information can be an added feature to our system so that the microcontroller based dam gate control system can be more accurate. Also our group mates had proposed a Raspberry pi based dam control model.

Now days in electronics field we need compact circuitry and small size the PLC based system is huge and the controller system need a PC then this is large circuitry then we are proposed new technology control the dam gate using raspberry pi. This is mechatronic based system. When we use the raspberry pi then no need to use the CPU of computer, then the circuitry are very small. Raspberry pi is working as a small computer

III. PROPOSED SYSTEM

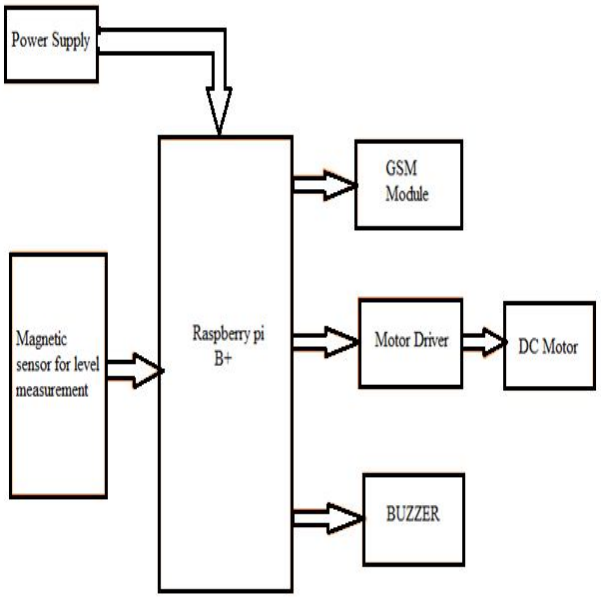

Fig 1. Block Diagram of Automatic Dam Gate control system using raspberry pi b+

The water level at different levels is sensed according to which the gate is closed or open. Dams are typically constructed with a drain or similar mechanism to control water levels in an impoundment for normal maintenance or emergencypurposes. Sensors senses the various levels of waterWhenever the water level rises or decreases and comes

in contact of any sensor then the circuit is complete. The water level rises above the highest level or decreases below the lowest threshold level then the sensor circuit triggers the raspberry pi. Raspberry pi will drive the DC motor through the motor driver relay circuit. The dam gate connected to the DC motor will also move and it will get opened or closed according to the water level

IV. RESULTS

The dam gate is sense two conditions one is the dam water low level condition and other is dam is over flow. These two condition dam gate are working. In this low level condition are water level are 20%. And dam gate are closed condition the gate are not open automatically when we need then authorized person open the gate manually otherwise it closed. In this condition one message are send to authorized person.

The dam gate second condition is overflow condition in this condition dam are 90% filled and water are overflow these are detailed in below. In this condition two message are send. Dam open when sensor sensed this condition and close some time when water level are decreasing. Its operate totally automatically open and close the dam gate.

[A] Reserved water

Step1- Dam level is low

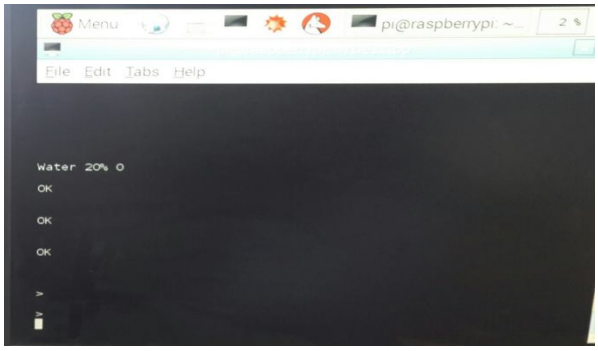

Fig:Water level indicate 20%

The first level of a dam gate control is the 20% water in the dam. It is also called as the reserved water for drinking. The dam water goes to the 20% then the magnetic sensor are detect these level and send to the logic 1 input to the raspberry pi. The raspberry pi prints the water level 20% this shown in above fig.and simultaneously send message toauthorized person. In this levelonly one message are send only for control room.

In this level dam gate completely close the dam are open manually only, because the water are reserved for drinking purpose. The dam are open only authorized person (operator).

Step2-Message send to authorized person

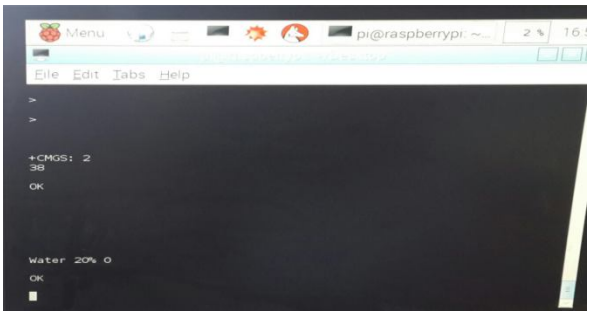

Fig: message send to authorized person

When water level are 20% GSM send one message to control room and also display on screen the +GMGS ie. The GSM are sending message to authorized person this result are shown in above GSM message sending image.

Step3-Message deliveredto Authorized person

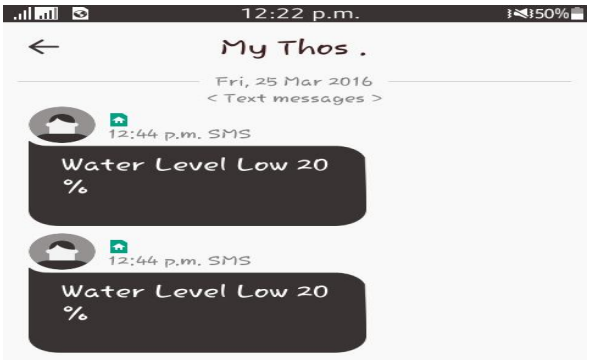

Fig: Message delivered to authorized person

When GSM are send the message these messages are received to authorized person.The message is Water Level Low 20% and dam gate are closed.When its need to open dam his open manually when water level are below 20%.

[B]Dam is overflow

Step1- Display water level 90%

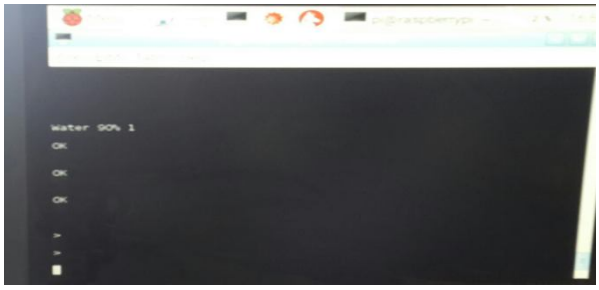

Fig:Water level indicate 90%(Dam overflow)

When dam water level goes to the above 90% then magnetic sensor are sense and send the logic1 input to the raspberry pi. Then raspberry pi acts on this input from sensor. Raspberry Pi display the water level 90% and simultaneously dam gate are open again send two message first message for authorized person second message to dam surrounding people. This result displays the water percentage.

Step2-First message send to authorized person

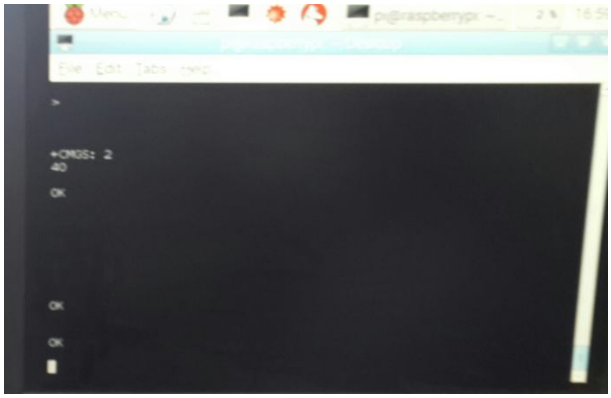

Fig: first message send to authorized person

When sensor are indicate the water level high then monitor display water level 90% then simultaneously the GSM send the first message to the authorized person they are shown in fig. Its display AT command and ok ,ok for indication for the command are received properly and working is correct.

Step3-First message delivered to authorized person

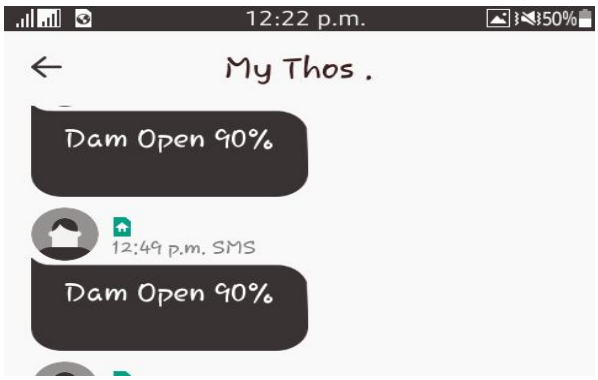

Fig: First message delivered to authorized person

The GSM are not sent two message at a time then GSM are send one by one message. The first message is delivered to authorized person. The message is shown in fig. these are Dam open 90%. But it's alert to control room its emergency.

Step4 - Second message send to dam surrounding people

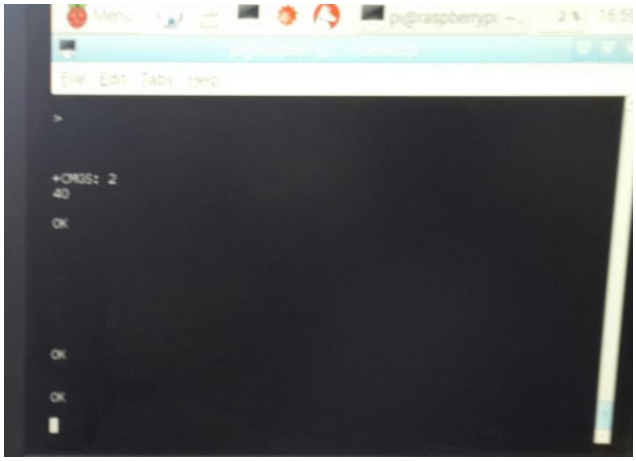

Fig:Second message send to dam surrounding people

The GSM send the second message to dam surrounding people for alert dam is over flow and gate is emergency open. That time the control monitor is display AT command of send second message. This is shown in fig. And the ok, ok, are display because working is correctly.

Step5-Second message delivered to people

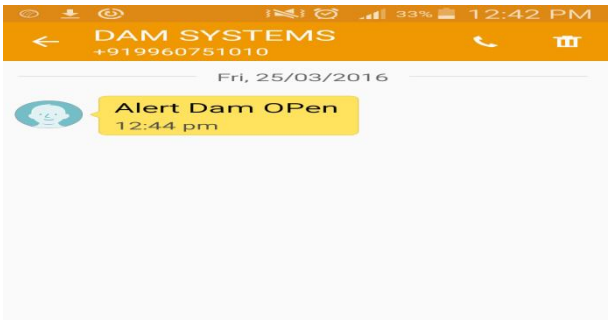

Fig: Second message delivered to dam surrounding people

The second message send by GSM are delivered to the dam surrounding people. Alert dam is overflow and emergency gate are open. This message are security purpose for surrounding people safe from flood and also known about incoming water from dam its good for farmer.

V. APPLICATION AND ADVANTAGES

Advantage

- The water wastage can be reduced.
- Efficient utilization of water resources can be done.
- We can keep the record of the water usage and indications can also be given to the people at various situations.
- Example, during heavy rainfall the chances of flood can be indicated.

Application

- Use of Dam Gate System in Power Plants.
- This dam gate control system operation can becombined with the operation of the geothermal and nuclear power plants for generation of electricity.

VI. CONCLUSION

As we have followed through detail execution of our project with the help of raspberry pi along with advance features of it. We can take full advantage of raspberry pi in any application of automation and electromechanics area. Although we can extend our work in the sense that we can achive more precise and accurate results. The components circuitry we can replace for achieving better operation is less time and less water use using raspberry pi.

Raspberry pi we can also design in conjunction with GSM so as to we can achieve the important feature i.e. security for our system.

ACKNOWLEDGEMENT

It is a great pleasure for us to present a project **"Automatic Dam Gate Control System using Raspberry pi"** where guidance plays an invaluable key and provides concrete platform for completion of the project.

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