GSM based Mobile Phone Controlled Dam Gate Controlling with High Level Protection

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Abstract--- A system for early controlling of dam gate's at particular location in any water dependent appliance and apparatus used in multi dwelling facilities. In practice, conventional controllers were used to control the system however their parameters are empirically adjusted. Besides, the operation of these controllers relies on the measurements provided by water level sensors located inside and near the dam. This system provides a high level of safety for dam applications. The microcontroller used in this projects is 8051. The water level sensor estimates the dam water level; if the water level increases a particular threshold value then an alert signal will be provided by buzzer unit And We receive the massage through GSM Module. Similarly Microcontroller will trigger the relay drive unit, which will tend to open & close the gate automatically with the help of motor and similar massage signal will be passed to control room units through GSM module. The required parameters of water level, message alert signal and buzzer alert signal will be displayed in LCD display.

Keywords: GSM Module, Microcontroller, Water Level Sensor, DC Motor

I. WHY OUR PROJECT?

Now-a-days water scarcity has become a serious problem 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. Also till date the control mechanism of the dam gates are done manually and not using PLC. But there are lots of errors in manual method. Also the PLC based system is huge and hence suitable for major dams due to its cost. For medium and small dams like irrigation dams does not require such huge PLC systems. So to reduce these problems an Automation control system is proposed in this paper.

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 1986 Davidson, E.G. proposed a control system [2] for efficient working of hydroelectric power plant in North of Scotland with the help of Visual Display Units (VDU's).This proposed VDU system guided us in making a GUI control panel for operator. A paper was proposed by Xavier Litric [3] related to water management in dam using SIMO systems. This SIMO system deals with the real time calculation of the upstream and downstream flow of the water in dams. By observing these factors and accordingly operating the gates can be carried out. The system we proposed can be merged with the afore 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 Syed Sheraz Mohani and his group mates had proposed a PC based dam control model [4] wherein they introduced the concept of divison of reservoirs into upper and lower reservoirs and efficiently use the dam water. But the overall control was through PC and needed an operator. In our system we are mainly using microcontroller and a PC for the mode that microcontroller don't support. So this reservoir sub division model can be merged with our system to get efficient resource conserving results. Marcel Nicola, Florin Velea have proposed a system [5] for effective control of Hydropower Dam Spillway using PLC/SCADA system. But recently Montanhydraulik [6] manufacturing company has installed a PLC based control system for controlling the operation of dam gates.

This system was successfully installed on a large scale in foreign countries and the only dam in India where this system is installed is Indira Sagar Dam in Madhya Pradesh. But this PLC based system is costly and effectively applicable for major dams and not for small and medium dams like irrigation dams. Junmei Guo & Qingchun Chen also proposed a system using Fuzzy Logic in PLC/SCADA system [7] for the control of dam gate operation but since here too the PLC is used it can be suitable for major dams. Slivnik, T. Kodric, M.; Antauer, M. proposed a protection unit [8] for the dam gates which overcame some drawbacks of other existing system like not detecting anomalies, such as asymmetric movement of gates, faults in drive gearwheel etc. In our paper we have provided the limit switches for proper movement of gates. So we can use their system with our system to overcome other anomalies too. Our system is though proposed only for the proper control of gates but further it can be extended for proper supply of water for irrigation and to households too by implementing additional system which was proposed by Puig, V. , Ocampo-Martinez, C. Romera, J. Quevedo, J. Rodriguez, P. Campos, S. Negenborn. Their system [9] comprised of a model predictive control which considers the flow control strategies of water in dams. In reality there are many problems that occur in dams like deposition of silts, sediment souring which creates negative impact on flood control and water draining, water body quality, aquatic biology and marine navigation, etc.

So to avoid these problems we have to take some feasible measures of disaster reduction which was proposed by Lihua Feng & YanWang. Their proposed paper [10] clearly explains the above mentioned factors and their eradication measures.

III. HARDWARE IMPLEMENTATION AND OPERATION

A. *Sensor*

For implementing our proposed system we used normal single strand conductors but when implemented we didn't get fruitful results. There was not enough flow of current in conductors to effectively trigger the microcontroller. So we made a sensor PCB with etched conducting strips on it sensing various levels shown below in fig.3. If implemented in real, this PCB sensor can be implemented but by applying AC power to it or we can also use magnetic pressure sensors or some other industry purpose level sensors. Further as a part of our sensor circuit we are using four npn transistors (BC 549) for each of the sensor. These transistors amplify the sensor output so that it can have enough strength to trigger the microcontroller. Fig.1 depicts the sensor circuit in which five sensors are used at various levels (very low,1/4,1/2,3/4,full). Except the very low level sensor all others are connected to the transistors and whenever water level increases or decreases and comes in contact with each sensor the corresponding transistor conducts and amplify the sensor output . Special arrangement is made to indicate the various water levels using an LCD display at the operator control panel. When water reaches each and every level then respective level value programmed in microcontroller will be indicated in LCD and the operator will either open/close the gate. The main reason behind using the transistor amplifiers after the sensors is to provide sufficient energy to the sensor output to trigger the microcontroller.

IV. BLOCK DIAGRAM

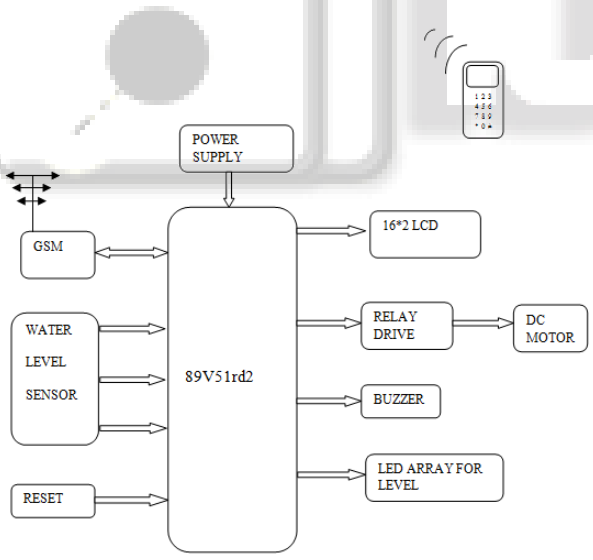

Fig. 1: Block Diagram

Fig. 1depicts the block diagram of Microcontroller AT89S51 based Dam Gate Control System. The proposed system uses five sensors to sense various levels of dam water. Whenever the water level rises or decreases and comes in contact of any sensor then the circuit is complete and current flows due to which the corresponding transistor conducts and circuit is closed. The output of the sensor circuit triggers the microcontroller. Whenever the water level rises above the highest level or decreases below the lowest threshold level then the sensor circuit triggers the microcontroller. According to the code written and burnt in the microcontroller, it will drive the DC motor through the motor driver relay circuit and the dam gate connected to the DC motor [11] will also move and it will get opened or closed according to the water level. To operate the gates of dam at the water levels which are not supported by the system an operator can be placed at the control room to control all the operation of the dam. The operators system will be connected to the microcontroller through the USB interface. This is the main interface through which the operator is connected to the microcontroller and without this interface code cannot be burnt in the controller. Also the operator is provided with the facility to indicate the people living in the surrounding areas of the dam about the water usage for irrigation and alarm the people to let the released water from dam to their fields.

A. *Implementation of Proposed System*

In this section the hardware that we have developed to implement the proposed system has been explained. There are various components we used to implement this system. The following figures are the snapshots of the system we implemented. The whole system is divided into various sections and each are explained separately.

Here five water level sensors that are etched on a PCB. This PCB will be placed in the dam. Whenever the water level touches each sensor line then the corresponding transistor amplifies its input and this sensor data is used to trigger the microcontroller.

This kit is interfaced with the microcontroller kit. The main reason behind using the transistor amplifiers after the sensors is to provide sufficient energy to the sensor output to trigger the microcontroller.

The LCD interfaced [11] to the microcontroller kit. The LCD is used for indicating the operator about the frequent level changes in the dam. LCD will be placed in the control panel. The LCD used is a 16x2 LCD with the green backlight feature. In this LCD the water level will be continuously displayed according to the changes in the water level in dam.

The motor driver circuit using electromagnetic relays [11]. Four SPDT relays are used one for opening the gate, one for closing the gate, one to turn 'ON' the buzzer/alarm and last one for future use. Four Transistors (BC 549) are connected to each relay to activate them. Also four LED's are connected to each relay and whenever the relay is ON then the corresponding LED will glow.

The microcontroller kit with power supply. AT89S51 is the microcontroller used in this system with 8MHz crystal frequency. The microcontroller is programmed to control the operation of gates and indicate the operator the exact level of water in dam using LCD. Port 0 is interfaced with the LCD module and Port 2 is interfaced with the motor control circuit. Port 1 is interfaced with the sensor circuit. +5V power supply is given to the system.

The actual arrangement of dam model where brushless DC motor is used to open or close the gate. An additional feature of limit switches is also provided for inspecting proper movement of gate. There are two limit switches attached one at top and another at bottom. The supply to the motor is given through these limit switches. Whenever the gate is opening then till it touches the switch its movement will be on but as soon as it touches the switch then the supply to motor is cut and the gate movement stops.

Similarly the mechanism works while closing of gates. This feature monitors the proper operation of dam gates.

V. RESULTS

The system we proposed has been successfully implemented and observed the results. We found that the time taken for the dam gate to open and close is accurately synchronized with the increase or decrease in the water level because of the use of Low Speed High Torque DC Reduction Gear Motor having 100 rpm. Due to the use of GUI operator control panel the dam gate can be opened or closed at any time as and when we require which increases the system reliability and flexibility. Fig. 9 shows the operator control panel. A graph is plotted continuously on the panel indicating the change in the water level every second which makes the system operator friendly and reduces his job of continuously monitor the water level in dam.

VI. CONCLUSION

Since wired technology is used in our proposed system there is scope to further modify it by using wireless RF technology.Thus the communication between the controller and the driving element can be established wirelessly. Improvements can be made with minor changes in this model by eliminating the operator and providing the complete control to microcontroller (automatic level control). It can be used for level monitoring and control in industries. Control of irrigation dam and other large dams used for power generation and water supply should be different; as control of both types together will be very complex since there are total 5200 dams (approx.) in India. Therefore a major future work can be possible in which a centralized control of all the dams in a state using GPRS or other wireless technology under central government can be beneficial to the whole country.

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