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Short Message Service based Water level monitoring for DAMS using Global System for Mobile Communication

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ABSTRACT

Jun to October is the monsoon period in India .after independence to supply water for farming and to control flood situation dams were constructed with the growing population the problem of water shortage took place so it was and is necessary to save water many developing technologies were used to save water.
Today's man notices the water level in the dams, water used for farming as well as for drinking too be noted. At the time of floods many problems are faced lack of the means of transport and natural calamity in the reports. To solve these above system is developed with the help of science and technology.
To check the water level a sensor is there which shows the water level after every interval which give it and also a GSM kit there which sends water level through a Short message on any Mobile or any other GSM system

Keywords: Global System for Mobile Communication (GSM), Voltage Ref. (Vref.), reliability, Analog to Digital (AD)

1. INTRODUCTION

During rainy season most of the dams in India are not accessible to the irrigation department. Sometimes it rains heavily during the whole night. In such situations the water level changes drastically. So it is very important to get an updated water level for the safety of the dam as well as the nearby villages which may get flooded because of drastic change in the level.
Not only in rainy season but in any season if we come to know the water level in dam then we can plan the use of water. As need for water increases, plans should be formulated to extend the use of water. Rather than finding and developing new sources, water often can be less expensively provided by conservation and equitable distribution of existing water supplies. Every cubic foot of water recovered as a result of improving water measurement produces more revenue than the same amount obtained from a new source. Better measurement procedures extend the use of water. Permanent water measurement devices can also form the basis for future improvements, such as remote flow monitoring and canal operation automation.
Therefore we decided to find a solution for this situation which can be controlled if we get various levels of water at different time. Our approach was to design a full proof system which should provide the user with various water levels at various times. Hence we decided to use a Global System for Mobile Communication (GSM) which will message the water level at any time. As GSM is independent of the distance hence we can get the data about water levels at any place and anywhere, which makes the system very useful.
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2. ANALYSIS

India's irrigation development in this century, and particularly after independence, has seen large number of large storage based systems, all by the government effort and money. However, in pre British period in India, there were practically no large reservoir projects in India. Even in British period, a few storage structures were built only in the beginning of this century. Post independence India, however, has seen more than 60% of irrigation budgets going for major and Medium (M & M) projects.

India, with a geographical area of 3.3 million square Kilometers (Km), experiences extremes of climate. Annual average rainfall in the country is of the order of 1170 mm, which is equivalent to nearly 40002 cubic Km of water. However, the rainfall varies from 100 mm in Western Rajasthan to over 8000 mm at Cherrapunji in Meghalaya, considered wettest spot on earth.
It is suggested that the reason large storage based system are dominantly appropriate in Indian conditions is due to the prevalent climatic conditions in which except the four monsoon months, for the rest of the year, Evapo - Transpiration needs are higher than rainfall. Hence to make the rainwater available across the year, it is important to store it to make it available for the rest of the eight, non - monsoon months.
We should keep a tight watch on the quantity of water in dams. The amount of water in dams decides the potential for irrigation. The most important use of knowing the quantity of water is to manage the amount of drinking water for the people.

3. INNOVATION APPROACH

The block diagram of the whole system used for measuring the water level and sending it to the authorities is shown below.

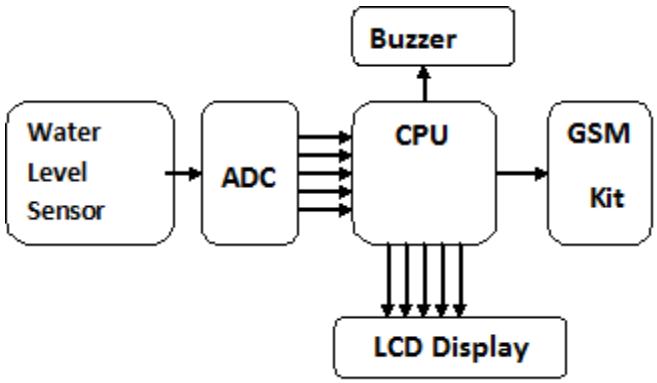

Figure 1 Block Diagram

Collection of data using an acquisition system and sending it to remote user on his mobile phone as a message is the basic idea behind the system. The system consists of a sensor which will take water level reading. The sensor will be connected with a float which will be floating on the water and as the level will change the voltage output of the sensor changes. This voltage is given to analog to digital converter. Here the value is converted into digital value using 10 bit ADC. The processing unit of this system will take decision on the basis of the reading and will message it to the end user using a GSM module. The main and innovative idea behind this project is of messaging the water levels at various times, which will help the authorities to plan a proper use of water which will greatly help in conservation of water.

Equations

The sensor we are using is potentiometer. (Variable POT).The angular movement of the POT is converted into linear motion.
As we know that the maximum rotation of POT is 270 degrees. Hence each rotation will cause a change in resistance which in turn will change the voltage. The voltage obtained is then given to the ADC channel of ATmega16.Following calculations will show how change in resistance is converted into change in angle.

Concepts -
As we are using 10 bit ADC hence the resolution will be

$$\text{Resolution} = \frac{Vref}{(1024-1)}$$
$$= 4.8875 \text{ mV}$$

This means that the minimum voltage our system can sense 4.8875mV,which is approximately 5mV.Therefore for 1 degree change in angle our voltage will change by 5mV.Hence we can say that the change in voltage is perfectly linear

to the change in angle. Hence we can accurately measure the angle which is required for our further computation of the water level.

$$\text{Angle} = \frac{270 \text{ x ADC\_Result}}{1023}$$

$$\text{Angle} = \text{ADC\_Result} / 3.79 \quad \ldots\ldots (1)$$

From the equation 1 we have the angle of rotation of the pot. Hence using the equations in the figure the water level corresponding will be calculated.
Following figure shows the method of water level measurement:

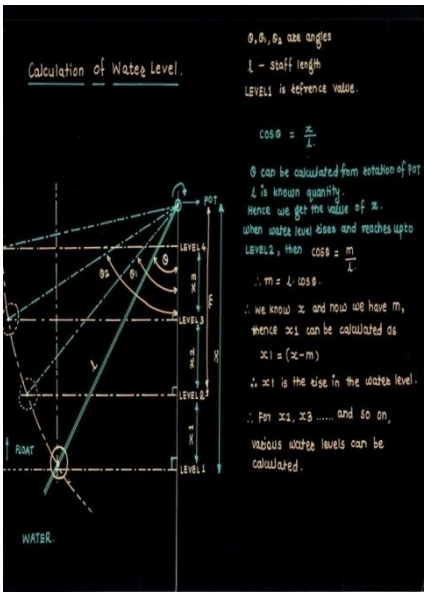

Figure 2 Concept of level Measurement

The calculated water level is then saved and is sent through short message service.

4. CHALLENGES AND LIMITATIONS

Calibration of a system is always a difficult job. As the output of pot is a voltage value which is a floating point value. We are using an 8 bit microcontroller which cannot handle floating point calculations. Hence to calculate the accurate value of the angle was difficult. So we calculated the value of the 270/1023 and multiplied it with the coming adc_result which gives us the value in degree. This was having an error of 2^o which is acceptable.

a. Using of atmega16

Port c of atmega16 was used as an I/O port by configuring it as output port. But when the hardware was tested it was not working as output port. We checked everything regarding the declaration of ports as input or output port. When we read the data sheet for working with I/O ports then we came to know about the fault. Port c in atmega16 was used as jag port by default. So unless we disable the jtag properties of the port we cannot used it as output port. Hence by disabling the jtag support we were able to use it as I/O port.
Baud rate for serial communication is the deciding factor for proper communication between two devices. Unless it is set properly the communication will not happen. For deciding the baud rate, oscillator frequency is the most important factor.
Here we are using 4800 baud rate at 1 MHz oscillator frequency with an error of 0.2% which is acceptable. The maximum data rate achieved is 62.5kbps.

b. Selection of GSM module

GSM module simcom300 is used for generating a short message. The communication between the GSM module and atmega16 will take place using rs232 protocol at 4800 baud .the data rate achieved at 4800 baud and 1 MHz frequency is 62.5kbps with an error of 0.2 % which is acceptable.

Here we came across an interesting error. Whenever our CPU was sending the data to the GSM module, the module was also responding to various commands. Hence we also have to receive the acknowledgement from the GSM module. Unless we receive the acknowledgement the whole program used to stop. So we then altered the code and started receiving the acknowledgement. But still it was not working as expected. So using terminal software and literally counting the number of characters it sends for various at commands, we made arrays to receive only that many characters. And after that the code was working properly.

The GSM module is having a slot for SIM (subscriber identity module).we can use any of the SIM depending on the service provider. This will generate a message to the desired person according to our command.

Figure 3 Working Hardware

5. CONCLUSION

Microprocessor-based technologies and a new physical design enable the system to perform a wide variety of functions in service of a larger audience of users. Besides the ability to perform customized data gathering and processing of a large suite of sensors, the system can rapidly disseminate that information via a multitude of pathways. Foremost is the critical need to accurately and reliably capture water level measurements.

The former water level measurement system, based on technologies and methods suffered from some major limitations, namely:

- nonlinearity, aliasing and biasing problems with the analog-to-digital recorder;
- susceptibility to recording error due to reliance on human observations;
- A need for constant tending and maintenance.

Our system will replace these errors as there in no human intervening. Hence those errors can be reduced. Moreover the user will get those water levels anywhere sitting at its home or office. Hence no need to visit the place for taking readings, which will reduce the cost as well as time consumed.

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