iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 2 **Issue:** Issue- II **Month of publication:** October 2014

DOI:

Special Issue-2, October 2014
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology(IJRASET)

Automated DAM Monitoring System

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Abstract: To develop an automated dam controlling system in order to
1. Measure velocity of the water flowing into the dam.
2. Measure pressure at dam walls.
3. Indicate current water level.
4. Properly channelize the water for irrigation and power generation.
5. Monitor vibrations of the dam structure to ensure safety.
Our solution helps in improving the ease of monitoring a dam system, thereby enabling measurement of water inflow velocity to dam and pressure measurements in dam walls. During floods the dam is subjected to a heavy volume of water. In orderto ensure the safety of dam from large volume of water in the upstream and to prevent flooding in the downstream, proper channelizing is essential. Our solution provides a scheme in order to channelize the water in dams effectively.

I. INTRODUCTION

We introduce an automatic monitoring and control system of dams. This scheme enables easy controlling through its smart sensing and data acquisition technique using NI Compact RIO, LABVIEW8.2.1 .Firstly data is acquired from various sensors in order to measure water height in dams, velocity of water , pressure in dam walls and vibrations. The output from various sensors is obtained as voltage which is fed into another channel of NI 9201 I/P module. LABVIEW monitors and analyses the data from the sensors and controls the sluice gates for sustaining the required level of water, channelizing the water for irrigation and power generation using the signal generated from NI 9263 analog output module.

II. THE SYSTEM SETUP

The entire dam controlling system is divided into separate dedicated sub-systems which are explained below.

A. Velocity Measuring System: Pivot tubes can be used to indicate fluid flow velocity by measuring the difference between the static and total pressure in fluids.

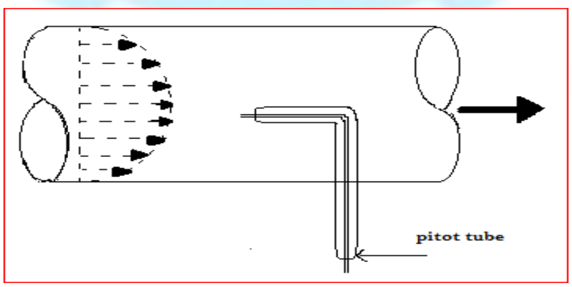

Fig1: Velocity measurment using pivot tube

V = sqrt [2 * {pt -ps} / R]

Where,

V=velocity of water

Pt=total pressure

Ps=static pressure

R=specific density of water

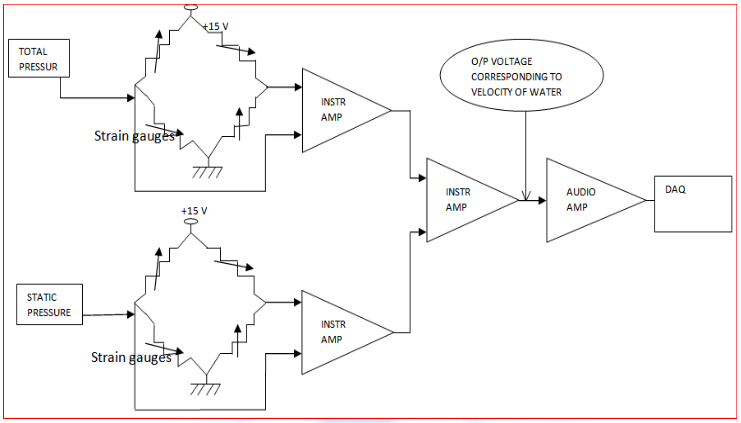

Fig2: Wheatstone bridge circuit to find velocity of wate

The strain gauges form the four arms of the Wheatstone bridge in a full bridge pattern. When resistance of all the four arms of the bridge is same, the bridge is said to be balanced and the output of it will be zero. When the fluid flows along the pitot tube, there comes to picture the static pressure and the total pressure which exert a force on the diaphragms. This will lead to change in resistance in the four arms of the Wheatstone bridge, which make the bridge unbalanced and produces a corresponding voltage that is proportional to the pressure exerted as its output. So the bridge converts the force change information into milli volt output. This milli volt output voltage is amplified using a voltage amplifier to 0-10 v which is fed to the DAQ .

B. Channelizing System For Irrigation And Power Generation:

Now, as our project is concerned about multipurpose dams, 2 channels are devoted for generating power from hydro electric plant. We are more concerned about the input power that is given to the turbine so called water power

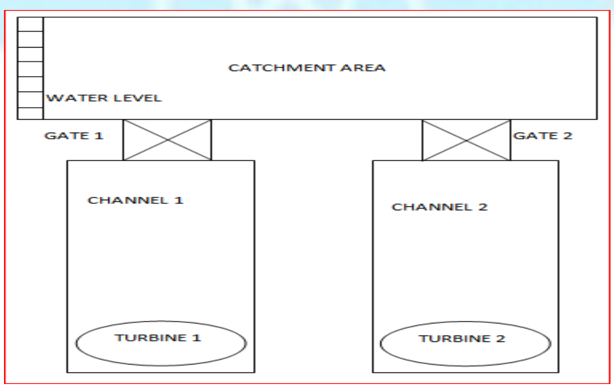

Fig3:Working of turbines

WATER POWER=(W*H)/1000KW

Where ,W=r*g*v

r=water density

g=acceleration due to the gravity

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v=volume per second

H= net water head

Now, depending upon the volume of water accumulated inside dam ,the channels of the dams can be controlled which is simulated in lab view using LED'S.By allocating 2 different channels we can judiciously make use of water obtained in flood in generating power ,thereby conserving power. Mechanically, it can be achieved using motors of 2 different ratings depending upon the water level.

C. Vibration Measuring System:

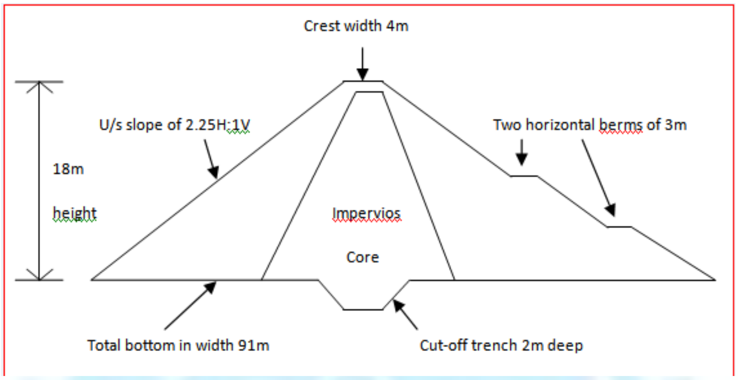

Fig4:Basic sketch of an earthen dam

Normally structures of dams should be concrete enough to withstand the high velocity of water expected during flood. Vibrations pose a major threat to the dam structure. The hatched portion shown in the diagrams below represent the deformation in the embankment at various frequencies of vibration. Now in our project we can analyze the vibration spectrum with an aid of vibration sensor for which we use LIVM(low impedance voltage mode) accelerometer ,model 3035B1 and a high rate data acquisition card connected to the output display. The power spectrum comprising the frequency and the amplitude of the vibration is obtained using which the alarm signals issued.

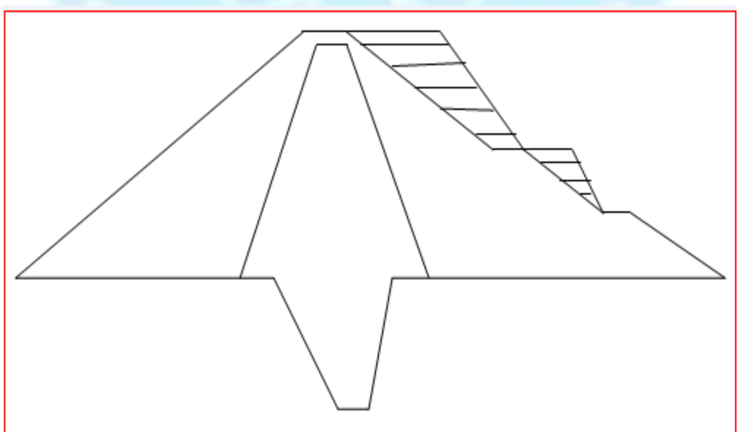

Fig4:Mode:1;Frequency:1.75 cycles/sec

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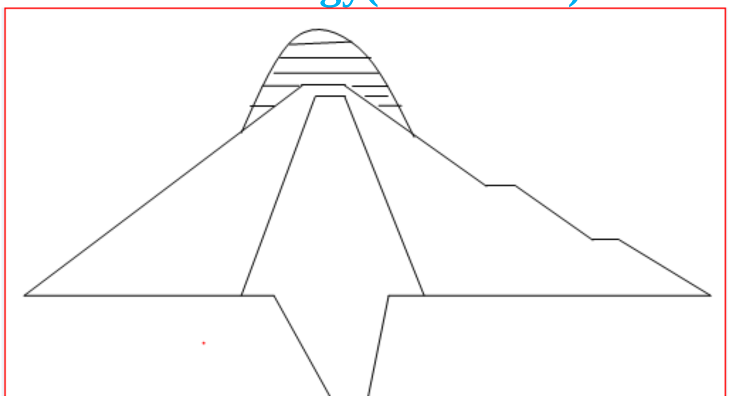

Fig5: Mode:2;Frequency:2.61 cycles/sec

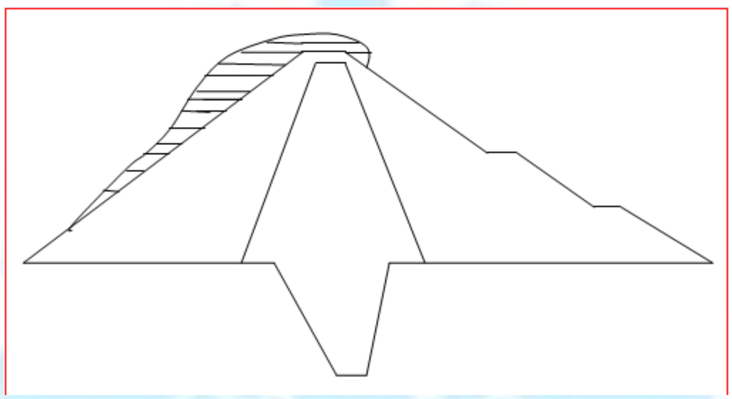

Fig6: Mode:3;Frequency:2.93 cycles/sec

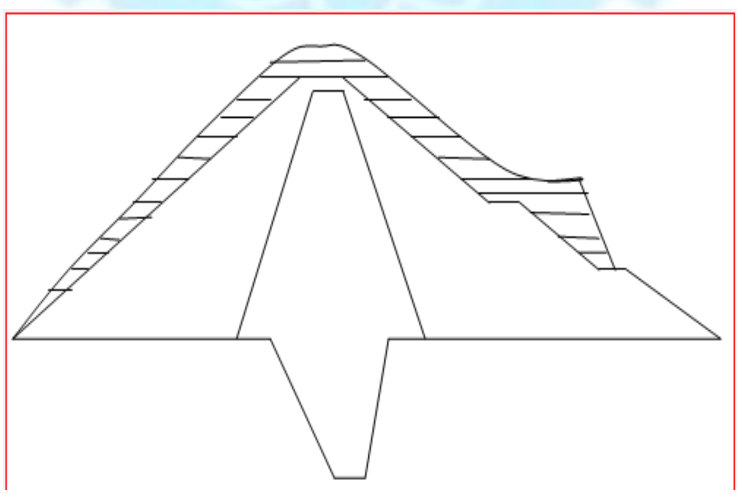

Fig7: Mode:4;Frequency:3.06 cycles/sec

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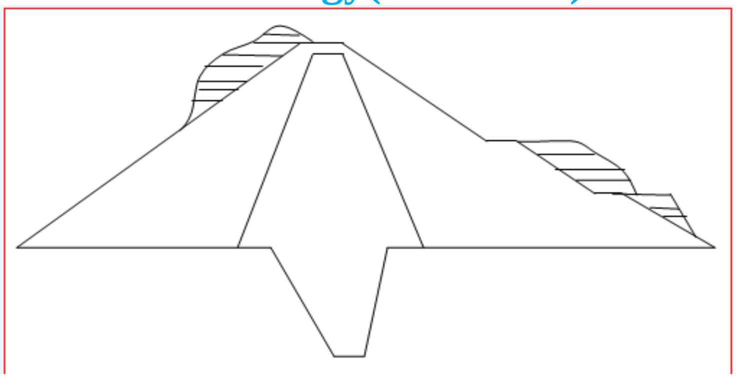

Fig8: Mode:5;Frequency:3.64 cycles/sec

D. Water Level Indicating System:

A low AC voltage is applied between the probe electrode and the reference electrode. When the water comes in contact with the electrode tip, a conductive path is established between the sense electrode and the reference electrode. This current is sensed, amplified and made to operate a relay whose contacts in turn can be used for controlling the sluice gates.

E. Pressure Measuring System:

To measure the pressure we use LL-V pressure sensor from Honeywell. The sensor has been designed for complete submersion in water. The output of the pressure sensor is compatible with the data acquisition card we use. The data from the sensor is acquired by the DAQ and when the pressure increases to dangerous levels, the sluice gates are opened.

III. THE FRONT PANEL

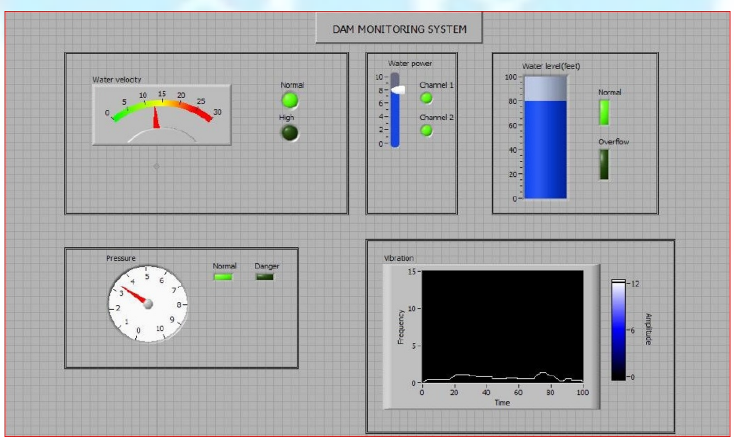

Fig9:Front panel of dam monitoring system

IV. BENEFITS

This project will very much prove to be economical. Though the initial cost of implementing the system might appear to be a bit high, in the long run, the running cost will be low. The economic benefits that arise out of this scheme will be an eye-catcher. Safety is the main aspect of our design. This project will reduce flooding drastically in the downstream side thus preventing crop damage and civilian losses and will be a boon to the agronomy. This system replaces manual control and as a result human errors are totally eliminated. Moreover our project aims at producing two different powers generated at “hydroelectric power stations” by regulating the water power to the turbine suitably depending upon the volume of the water available. Thus, it helps us optimize the use of water according to the availability of the water.

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V. CONCLUSION

Thus the automated dam controlling system measuring velocity, pressure, indicating water level, vibration and channelizing water for irrigation and power generation has been modeled using lab view .

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