Data acquisition system for remote measurement of expenditure in open channels

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Abstract

This paper sets out to improve the operation of measuring capacity using flow meters which are used in rivers or irrigation channels to perform these measurements.

The development is based on the change in taking readings to make the flow measurement using new technologies. This work is considered as an important factor in reducing time, especially when several measurements are required.

With this measurement process proposed, there is to be a reduction of measurement time to extend the operating life of the flow meter.

The project is working through an FM transmitter and receiver, which remotely send the information to provide the mechanical flow meters of conical cup type with vertical axis, to the receiver. This information is captured in the receiver, is filtered and passes a DAQ card. The information is processed on a PC through the Data Acquisition System, developed in Labview

Keywords: mechanical flow meters, testing laboratory, RF (radio frequency) communication, LabVIEW based system.

1 Introduction

Over time, water has been gaining importance, particularly given the growth of populations and the demands this puts on a dwindling resource, and we do not always recognize the importance of preserving and recovering water.

- One example is that caused by logging, which interferes with the precipitation of rain on the earth, the main source of fresh water. Another example is the pollution of rivers which often means that the water cannot

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be used for human consumption, this same pollution is not generating the development of flora and fauna, which also serves as food for man.

- As shown, the problem of supply is a serious issue and the problems in trying to conserve water as well as providing all the inhabitants with it, has to be solved.

- One solution is to control supply, which requires a dynamic measurement and we therefore propose to make an innovation in the measurement system.

2 Background

Mexico has an abundance of [1] dams, rivers and their tributaries and watersheds which carry runoff, especially during the rainy season.

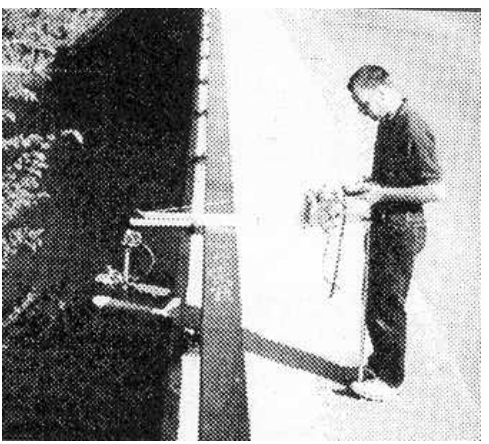

Figure 1: Measurement dams.

In both rivers, dams and basins, it is necessary to care for them and to control them. Periodic measurements are made across the Republic, of rivers and dams similar to that which is shown in (Figure 1).

The lakes and ponds were also studied and several problems were found, one being the decrease of water levels and this is due to uncontrolled logging of forests, encouraging the shortage of rain, causing such a low level of the lake, break as the hydrologic cycle (Figure 2) http://www.info.com/IMAGES.

The rain itself is the main provider of water and there have been behavioral studies of precipitation at the national level.

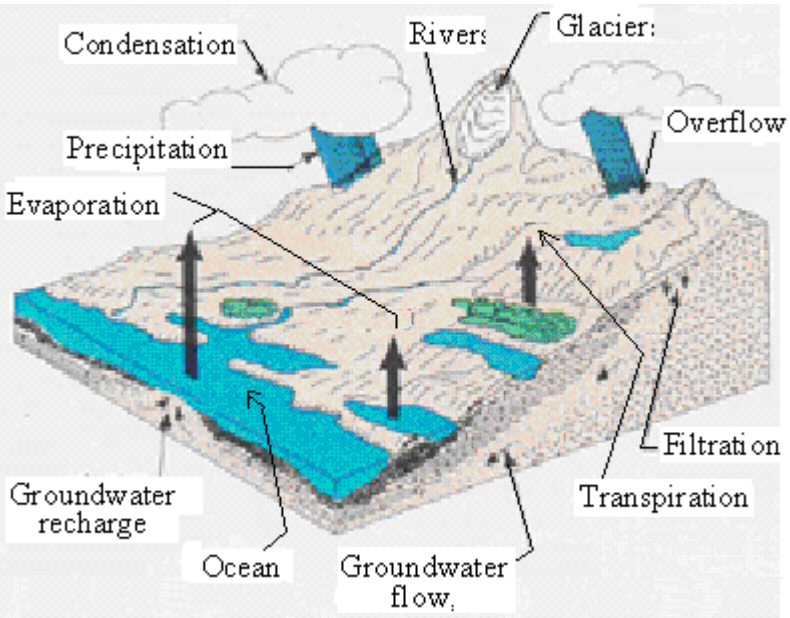

Figure 2: Hydrological cycle.

3 Justification

Before 1990 an inconsiderate use of water was made at a national level, since they did not obey any rules or restrictions; this caused shortages in some sectors of the population in some years. There began a revision of the water sector, finding that there were parts of town where the pay was minimal and there was no charge for the water in some sectors of the population, causing an inappropriate use of it, giving the government time to take certain measures to instigate controls.

Faced with this problem at all levels (industrial, agriculture, livestock and urban areas for domestic use), several solutions are proposed to take care of water, which are as follows:

- Investing in infrastructure and research on water.
- More efficient control of leakage.
- Investing in technology to improve the control of supply by means of measurements with new technologies.

This last point is that which we apply to the project. Although there are several ways of measuring, using different equipment and technology is one of the most economical.

4 State of the art

Having the technology capable of controlling the supply and control of flow by means of precise measurements would result in a significant saving of water [3, 4].

Flow measurements that are needed to control supply are carried out:

- Dams with level meter, mechanical flow meter and ultrasonic meters (Figure 5).
- In pipes of 4" diameter in proceeding with ultrasonic meters, the propeller, cell pressure and pouring.
- In pipes of ½ "for home use and magnetic propeller".
- In rivers in the venue with transverse mechanical flow meter (Figure 4).
- In open channels mechanical flow meter.

The most common gauges are the mechanical flow meters that are manufactured in Mexico, the Price model (Figure 3) is used to measure great speeds, from 0.02 to 4 m / s and the Pygmies, for low speeds of 0.07 to 2m /s, these models are similar in form but not in size.

Figure 3: Price flow meter

How to work both mechanical flow meters is as follows: you place it against the current and it starts to spin, the number of revolutions is recorded by a sound, light or magnetic signal, this relates to the time it took the number of pulses and aided calibration of your tables, you can get the speed either directly or through a digital counter.

The calibration is given by eqn. (1), [5]:

$$V = mx + b \tag{1}$$

where V = velocity m/s., m = slope of the curve, x = revolutions per second and b = a constant.

Table 1: To calculate the speed.

Time \ Revolution	1	2	3	4	5	10
40	0.0135	0.0313	0.0492	0.0670	0.0848	0.1739
41	0.0131	0.0305	0.0479	0.0652	0.0826	0.1696
42	0.0127	0.0296	0.0466	0.0636	0.0806	0.1654
43	0.0123	0.0289	0.0454	0.0620	0.0786	0.1613
44	0.0119	0.0281	0.0443	0.0605	0.0767	0.1577
45	0.0115	0.0274	0.0432	0.0591	0.0749	0.1541
46	0.0112	0.0267	0.0422	0.0577	0.0732	0.1507
47	0.0109	0.0260	0.0412	0.0564	0.0715	0.1474
48	0.0106	0.0254	0.0403	0.0551	0.0700	0.1442

Calculating the ratio r / t for different values corresponding to variable X, known as m and b in eqn. (1) to get the speed table, which is the intersection of the coordinates as shown in Table 1.

5 Common failures

The meters require maintenance in accordance with the use or area in which they operate and can become filled with sand and stop working, others are swept downstream by the flow and this can cause damage or deform the cups and require maintenance. Others are used in sewage and dirty easily, although it is noted that those that are used in clean water can last up to 300 hours of use without re-calibrating.

Circuit flow meter mechanical (Figure 4) corresponds to most of the flow meters and operates based on a battery connected in series with earphones to hear the pulse of each round. You must have a timer to take the time and count the number of turns; you can calculate the velocity by table 1.

6 Development of system

We consider the methodology for gauging a normal way and it was suggested that some improvements were:

- Improve communication, rather than hearing it on remotely.
- Reducing the sampling time of 60s to 10 s.

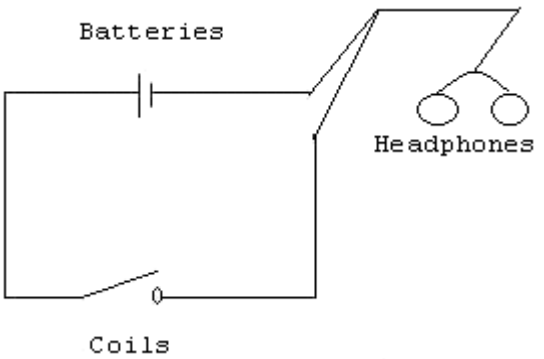

Figure 4: Circuit mechanical flow meter.

Based on the above a Radio Transmitter flow meter was implemented to detect the pulsations which are transmitted to the operator. The sampling time can vary from 10 to 20 seconds per station as required.

These signals are received at the receiver, so it has some LEDs that turn on at every turn of the flow meter. The LEDs are coupled to a light sensor, for such voltage variations to a card that works as a filter and this in turn, entered into the data acquisition card, PCI 6071E National Instrument, and then this information is processed in pulses by the computer, based on a Data Acquisition System developed in Labview Figure 5.

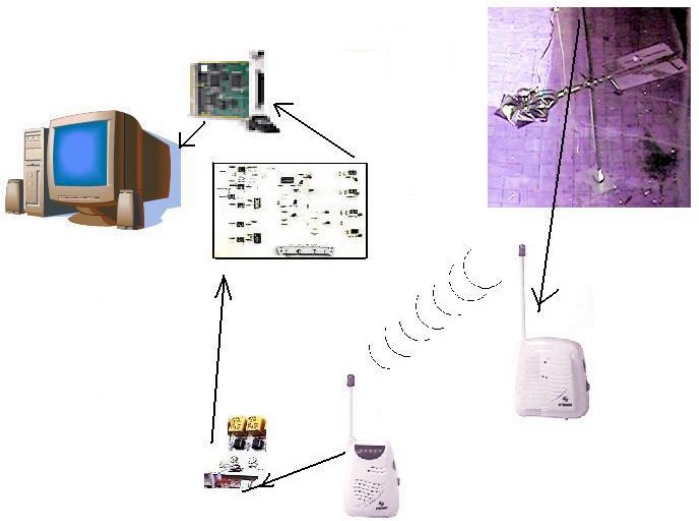

Figure 5: Data acquisition system.

This system gives us a menu, as shown below:

Main menu.

- Conduct a measurement
- See a Labview
- Exit system

Measurement to make a requested data flow meter, serial number, values of curve (m, b) location of the gauging of the capacity data, date and time.

Labview go - is the stage to make any editing changes.

Exit the system - it comes from a Labview.

7 Results and conclusions

The results are shown in [4] Table 2, where the characteristic equation of the meter, is a series of readings in the channel, giving a table with the values required in the performance of a measurement.

Table 2: Results of measurement.

REGISTRATION WITH CAPACITY Flow meter													
Polls			Flow meter			Speed = m * N + b			Section		
Destamcia the initial point	Total depth	Depth of observation	Revolutions	Seconds	Revolutions per second N	Slope m	Constant b	Calculated Speed	Wide	Area	Partial spending
m	m	m						m/s	m	m^2	m^3/s
0	0.235	0.141	6	15	0.400	0.2988	0.0087	0.12822	0.05	0.01175	0.0015066
0.1	0.235	0.141	12	30	0.400	0.2988	0.0087	0.12822	0.1	0.0235	0.0030132
0.2	0.235	0.141	9	15	0.600	0.2988	0.0087	0.18798	0.1	0.0235	0.0044175
0.3	0.235	0.141	22	30	0.733	0.2988	0.0087	0.22782	0.1	0.0235	0.0053538
0.4	0.235	0.141	22	30	0.733	0.2988	0.0087	0.22782	0.1	0.0235	0.0053538
0.5	0.235	0.141	14	15	0.933	0.2988	0.0087	0.28758	0.1	0.0235	0.0067581
0.6	0.235	0.141	14	15	0.933	0.2988	0.0087	0.28758	0.1	0.0235	0.0067581
0.7	0.235	0.141	16	15	1.067	0.2988	0.0087	0.32742	0.1	0.0235	0.0076944
0.8	0.235	0.141	14	15	0.933	0.2988	0.0087	0.28758	0.1	0.0235	0.0067581
0.9	0.235	0.141	10	15	0.667	0.2988	0.0087	0.2079	0.1	0.0235	0.0048857
						Total		0.22881	0.95	0.22325	0.0524992
Service hydrometric			Date:	24-Nov-08		No. Capacity			Comments:		
Station	IMTA		Flow meter	Gurley, Electro., 72514		Total Area		0.01175			
State:	Morelos			Marca,Tipo, Número							
Basin:			Operator:	JMN		Average Speed		0.12822			
			Home:	10:30 Hs.							
			Finish:	12:15 Hs.		Total Expenditure		0.00151			

The data acquisition system developed has been evaluated in a [2] system of flow meters and characterization of the count is done in a manner acceptable considering an error of 4%. This error could be improved with other technology if it requires more accuracy. This system will save time because the sampling

time is reduced considerably. This also reduces the time against a utility meter because it is less time in the water.

You get a page with the calculated data, data flow meter, the station where the meter is situated.

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