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A Novel approach towards automatic water conservation system

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Abstract: Water, the fundamental requirement of every individual is greatly in demand today in the growing population. This indispensible asset has to be conserved for the future use. In this paper we intend to give a solution to this problem. This paper reveals the practical demonstration of water conservation with the help of Lab View software. By designing a simple DAQ card and interfacing it to PC and controlling via lab view software, water conservation is achieved to a greater extent. Also by placing two flow meters each at the water station and at the consumer end we ought to know the exact usage of water by the individual, as a result of which, water theft is prevented, thus water conservation is done indirectly. Another advantage of this project is, by placing DAQ at the water station and controlling the water flow through it, exact tariff for the water consumption is paid by the individual which is sent to them through GSM.

Keywords: LABVIEW Software, Data Acquisition Card, Global System for Mobile communications (GSM).

I.INTRODUCTION

In urban infrastructure with the continuous economic growth, the water demand is also increasing. The water wastage is high due to many reasons such as leakages, mankind laziness, operator error etc. There is also problem of irregularity of water supply. The monitoring of water resource for industries as well as for domestic can prevent the occurrence of stealing water resource for these effectively. Therefore, the monitoring system of urban water supply has aroused extensive attention in recent years. Also water consumers today expect the treatment and distribution of their water to be efficient, safe and of high quality. Consequently, water supply board must be highly skilled and have both the technical expertise and the network capacity required in delivering this service. This system includes pumping stations, filtering/chemical treatment utilities, storage tanks and towers, the piping distribution network and the central dispatching unit which is completely governed via DAQ [Data Acquisition].

2. EXISTING SYSTEM

2.1. PLC and SCADA

In this paper, water conservation is done through the use of PLC and SCADA. By controlling the flow of water through SCADA located at the water control board, water flow is estimated and also theft detection is found automatically. The main disadvantage of this system is PLC requires skilled persons to operate them at water board and constant monitoring has to be done, which is a tedious process. Also PLC is very expensive to use it in government boards, which is quite complex. Another drawback of using PLC is, water theft detection can be found out with PLC, but the exact location of water leakage cannot be located with PLC.

2.2. Microcontroller

In this paper by the use of PIC microcontroller, water conservation is achieved. When more amount of water is sucked by the consumer through motor, automatically the solenoid valve connected to the PIC gets closed and a further, a beep alarm is issued by the microcontroller to ensure that theft is taking place. The drawback of this paper is only PIC governs the entire circuit, thus if any damage takes place to microcontroller then there is a heavy loss of water.

3. PROPOSED SYSTEM

In this paper we overcome the above seen drawbacks by using DATA ACQUISTION CARD to govern the water flow. This DAQ is placed at the water control board and is connected to pc for viewing the water flow through LABVIEW software. These are explained in the following section in detail.

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4. WORKING OF DAQ

Data acquisition (DAQ) is the process of measuring an electrical or physical phenomenon such as voltage, current, temperature, pressure, or sound with a computer. A DAQ system consists of sensors, DAQ measurement hardware, and a computer with programmable software. Compared to traditional measurement systems, pc-based DAQ system exploit the processing power, productivity, display, and connectivity capabilities of industry-standard computers proving a more powerful, flexible, and cost-effective measurement solution.

Devices in the PIC18f2x/4xk22 are available in 28-pin and 40/44-pin packages.

The devices have the following differences:

1. Flash program memory
2. Data memory SRAM
3. Data memory EEPROM
4. A/D channels
5. I/O ports
6. ECCP modules (full/half Bridge)

There are three types of memory in DAQ 18f45k22 enhanced microcontroller devices:

- Program memory
- Data RAM
- Data EEPROM

As Harvard architecture devices, the data and program memories use separate buses; this allows for concurrent access of the two memory spaces. The data EEPROM, for practical purposes, can be regarded as peripheral device, since it is addressed and accessed through a set of control registers.

5. COMPONENTS

The main components used are as follows

- Solenoid valve
- Relay driver
- Ultrasonic sensor
- Ph sensor
- Flow meters

5.1. Solenoid valve

A solenoid valve, otherwise known as electrically-operated valve is an automatic valve used for the purpose of removing the need for an engineer to operate a valve manually. Solenoid operates using an electromagnetic solenoid coil to change the state of a valve from open to closed or vice versa. If the solenoid valve is 'normally closed', when the coil is energized, the valve gets lifted open by the electromagnetic force produced by the coil. In this project we use two way normally closed solenoid valve. Simple on/off valves are the most popular as many process lines need flow or no flow. Solenoid valves can be used in factories/plants where compressed air is not available. They can also be used in place of larger valves such as electrically actuated ball valves, but without taking up anywhere near as much space. Operation is also much quicker than other valve technologies.

5.2. Relay driver

The relay driver used in the practical demonstration is of input voltage of 5V and provides a output of 230V and carries up to 2amps. This RS232 relay board-RS242 is the best suited to connect with DAQ. It is RS232 based card having relays for switching external devices and up to 9 digital and analog i/o that will help to monitor switches and different kind of sensors to monitor many parameters like temperature, pressure, light, touch, ph etc. this card is not only good for controlling relays but a perfect example for Data Acquisition applications. It uses existing com port which allows easy communication with card. Any programming language that supports serial communications(c, c++, c#, VB, VB.NET, Perl Java etc) can be used to communicate with RS242 very easily, the controller provides 4 relay output of control various electrical devices.

5.3.Ultrasonic sensor

Monitoring substances in a tank has always required a physical object of measurement to be submerged in a tank for accurate readings. This comes with a liability of periodically having to physically go to the tank check the water level. The ultrasonic distance sensor is a simple device that is accurate within +/- three percent. This is great alternative for monitoring tank and as well levels without having to physically go to location. This distance sensor is convenient, and a better alternative to what is available today.

5.4. PH sensor

VLSI mixed-signal processing allows the integration of large and complex data acquisition circuits on a single chip. Most signal conditioning circuits including multiplexers, PGAs, and SHAs, can now be on the same chip as the ADC. This high level of integration permits data acquisition systems (DASs) to be specified and tested as a single complex function. In this project ph sensor is used in the purification tank system to indicate the ph level of water. When the ph level indicates above 7 then water can be used for drinking purpose. Since this ph sensor produces an output of very high voltage, it is connected to a signal conditioning circuit which provides the desired output.

5.5. Flow meters

In this project we use turbine flow meters to detect water theft. Turbine flow meters systems combine turbine meters

and electronic instrumentation to measure volumetric total flow and flow rate. Each flow meter comprises of a cylindrical housing containing a precise turbine rotor assembly. The magnetic pickoff or picks offs are mounted in a boss on the motor body. As fluid passes smoothly through the flow meter, it causes the rotor to revolve with an angular velocity proportional to flow. The rotor blades or rim buttons passing through the magnetic field of the Pick off generate a pulsing voltage in the coil of the Pick off assembly. Each voltage pulse represents a discrete volume. The total number of pulses collected over a period of time represents the total volume metered. Of all flow meters we use turbine flow meters, because it has the following advantages. They are:
The plot of the volumetric flow is continuous since the turbine is constantly rotating with a speed. Of course, it would be zero if the flow stops as well. Repeatability is highly desirable factor in any flow meter. The rate of response for a turbine flow meter is quite fast (down to about a quarter of a second). Accuracy is very good (about +/- 0.25%). Rugged nature of the flow meter, allowing for daily usage

6. WORKING

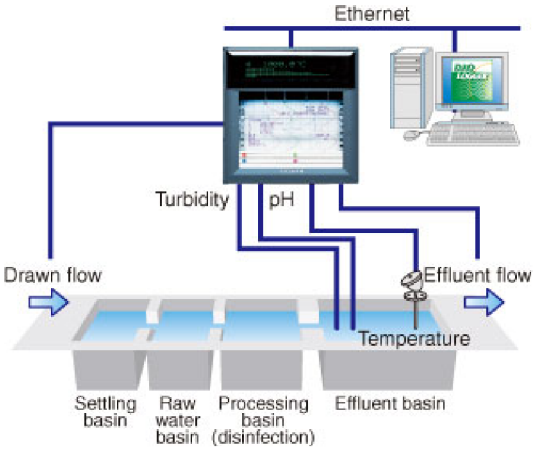
The working of this paper is broadly classified into 4 major sections (fig. 1). They are as follows.

6. 1. Water purification

Water consumers today expect the treatment and distribution of their water to be efficient, safe and of high quality. Consequently, water supply board must be highly skilled and have both the technical expertise and the network capacity required to deliver this service. This system includes pumping stations, filtering/chemicals treatment utilities, storage tanks and towers, the piping distribution network and the central dispatching unit which is completely governed via DAQ. Water distributed from the city dams are subjected to pass through the water purification tank which is shown below. In his section water passes through the chlorine tank in which proper ratio between water to chlorine is already set via lab view program and is controlled through the DAQ. In this way water purification can be directly used for drinking purpose or industrial purpose according to the consumer needs.

6.2. Water theft detection

This is the most important part of our paper, where water is conserved to a greater extent. In this section two flow meters are placed each at the consumer end and at the water board control, thus water flow is initially recorded in the 1st flow meter at the consumer end is reduced water theft/leakage is detected and is immediately detected at the water board through DAQ card. In this way water theft is detected efficiently



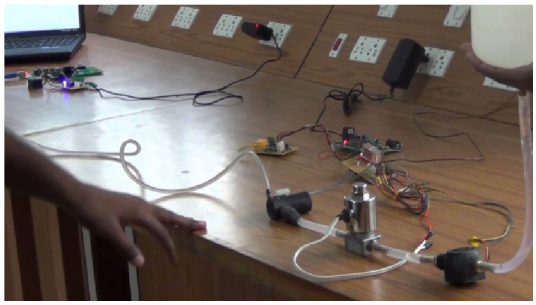


Fig.1 Schematic structure of proposed setup

6. 3. Tariff payment system

By the use of DAQ the exact consumption of water of every individual can be monitored and is indicated to him as sms through the use of DSM placed at the water control board. GSM (Global System for Mobile communication) is an open, digital cellular technology used for transmitting mobile voice and data services.GS M differs from first generation wireless system in that it uses digital technology and time division Multiple Access (TDMA) transmission methods. GSM is a circuit- switched system that divides each 200KHZ channel into eight T 25KHZ time-slots. GSM operates in the 900MHZ and 1.8GHZ bands in Europe and the 1.9GNZ and 850MHZ bands in the US. The 850MHZ band is also used for GSM and 3GSM in Australia, Canada and many South American countries.GSM supports data transfer speeds up to 9.6kbits/s, allowing the transmission of basic data services such as SMS. The use of GSM in this project is shown below.

6.4. Water conservation

In urban infrastructure with the continuous economic growth, the water demand is also increasing. The water wastage is due to many reasons such as leakages, mankind laziness; operator error etc. there is also problem of irregularity of water supply. The monitoring of water resource for these enterprises as well as for domestic can prevent the occurrence of stealing water

resource for these effectively. Therefore, the monitoring system of urban water supply has roused extensive attention in recent years. Also water consumers today expect the treatment and distribution of their water to be efficient, safe and of high quality. Consequently, water supply board must be highly skilled and have both the technical expertise and the network capacity required delivering this service. This system includes pumping stations, filtering/chemical treatment utilities, storage tanks and towers, the piping distribution network and the central dispatching unit which is completely governed via DAQ [Data Acquisition]. By following the above four methods and controlling it through lab view software and DAQ, water is conserved greatly for the future use. Water is a commodity that is essential to all life on this planet, and it needs our help. It is our responsibility to conserve our water. Water conservation diagram trough lab view is drawn below.

VII. Working of LABVIEW software

This Lab View (Laboratory Virtual Instrumentation Engineering Workbench) is a platform and development environment for a visual programming language from National Instruments (Fig. 2). Lab View is commonly used for data acquisition, instrument control, and industrial automation on a variety of platforms including Microsoft Windows, various flavors of UNIX, LINUX, and MAC OS X.

Fig. 2. Simulation in Labview software

7. CONCLUSION

This paper emphasizes the efficient conservation of water by using data acquisition card, governed through the lab view software in urban areas. With the implementations of this dynamic system, we can put a curb on the increasing water exploitation, thereby conserving water for future use.