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Battery Powered Ultrasonic Flow Meter

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Abstract

The ultrasonic flow meter is a liquid flow measurement device that emits ultrasonic signals into the flow path to measure flow of any liquid. Ultrasound techniques have several advantages over the conventional methods, such as orifice plate, venture and turbine meters, Transit-times at no-flow condition are utilized to eliminate the time delays in the non- liquid parts of the meter from the measured transit-times. The transit times and the transit time difference at no-flow conditions are calculated for the necessary environmental conditions, and stored in the flow computer. There are several flow meters available in the markets of warranty being extended from 1-2 years here we are dealing with extending battery life up to 6 years and make cost effective and efficient flow meter. A system is implemented with GSM module through advance technology. The ASIC GP-21 is specially designed to capture the pulses (sinusoidal tone burst). The associated electronic unit provide for processing of the sensor signals and visualization of the values of instantaneous flow rate and total fluid volume passed through the meter and fluid sensor and fluid pressure with for archiving of the measured data in specified time intervals in the internal meter memory unit.

Keywords*: flow computer, GP-21, battery life extension, GSM module*

I. INTRODUCTION

The Battery operated ultrasonic flow meter that currently present in market has life span of maximum 1 year. So we are trying to develop a circuit which have battery life of 6 years. The current ultrasonic flow meter required 19 mA per day for its operation so battery life falls drastically now main intension is to reduce current consumption along with cost effective system i.e. extending battery life. There are two principles widely used in commercially produced ultrasound flow meter; Transit time and Doppler method. Out of these two methods we ate using transit time because it give accurate result for pure water while Doppler shift are good for water containing impurities like sand .

In transit-time flow meters voltage signals of the form of sinusoidal bursts, chirps and spikes (an approximate delta function) are used to measure the transit-times. The choice of a particular form of the signal depends on the system. Sinusoidal signal usually used to measure low flow velocities like water and it is good for analysis by using CRO and DSO so we are using it in our flow meter.

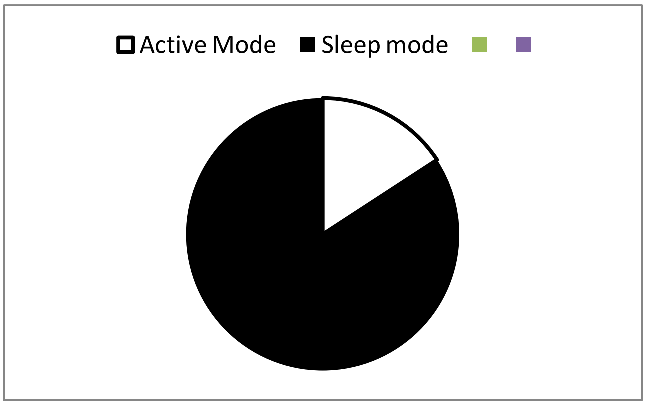
II. Working Principle

When water starts flowing from flow meter GP22 IC sends burst of 15 cycles through fire out pin and receives at fire in. Similarly after 20msec it send burst through fire in and receive at fire out. When liquid is flowing through flow meter after every 250msec new reading calculated. There are two modes exists first one when no liquid flow and other when water is flow at full pressure.

In mode 1, When water is at full pressure controller is active for 80ms out of period of 250ms i.e. one measurement cycle.

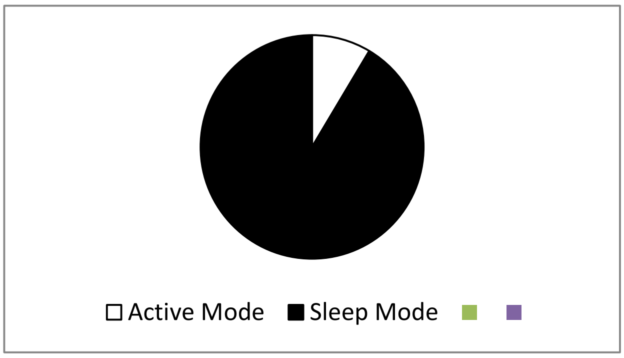
2.1 Measurement cycle when flow is at full pressure:

As shown in figure the active mode of controller is very less than sleep mode thus here power requirement is reduce drastically. When controller is sleep mode except its timer all other peripheral in are sleep mode so current consumption is become low. In this mode duration of active mode is 80msec while duration of sleep mode is 170msec.



2.2 Measurement cycle when no flow Condition:

When there is zero pressure in the pipe. Controller completes cycle within 40ms out of 250ms which is one period measurement cycle. In active mode controller require 400nA current where as in sleep mode it requires only 40nA. Similarly GSM module requires more current so we are turn on it only once a day.

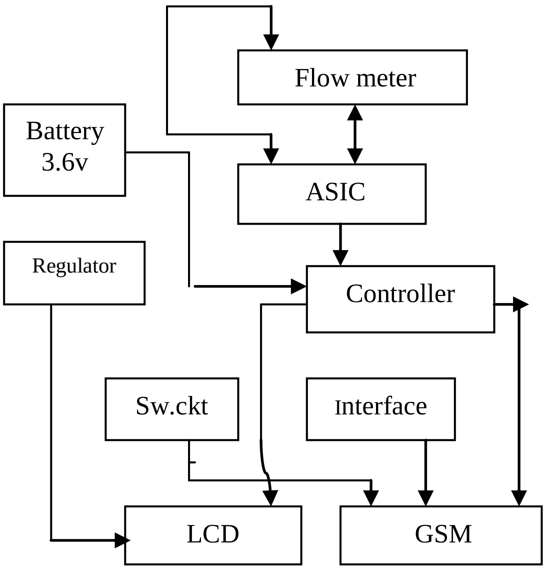


3. Methodology

In our system main challenge is to reduce power consumption at great extent and cost reduction per module as well.

As the system proposed in the paper [1] we are thinking flow meter with GSM module but it require much amount of power in its starting phase of initialization. To provide such large amount of current we use a special type of capacitor in our switching circuit to provide current. The controller we are used is extra low power so here also current requirement is reduced. In our circuit we are using ASIC IC GP22 which
play very important role in measurement cycle as it sends and receive pulse through flow meter and ASIC required current in micro ampere so here also current required for process is very low. During research we have found that even battery removed from the unit still circuit remain in on condition for 15min
Because a capacitor used to provide current for GSM module acts as backup power for whole circuit. It is also advantageous to use because no running is cycle is stopped due to low power. It also indicates that our circuit requires very low power to process. After that we add a supervisory circuit to indicate low power to microcontroller and as soon as controller get indication of low battery it saves the reading and stop working.

4. Block Diagram



The meter uses transit time technology to measure the difference in the waves travelling in and against the fluid flow direction. The two water coupled sensors mounted on the pipe are spaced 65mm from each other continuously emits the ultrasonic sound. As s1 sends signal along flow of water so it have more frequency and s2 send signal opposite to flow of water so it have less frequency. It is desirable to have ability to monitor the water consumption using ultrasonic flow meter.

Measuring the flow of clean liquid can be achieved by mounting transducers at an angle, by reflective blocks, or by channeling the flow stream between the sensors. Driving transducer 1 and monitoring the time it takes for transducer 2 to respond (t1), then driving transducer 2 and monitoring the time for transducer 1 to respond (t2), it is possible to calculate the flow rate (v) of gas within which the transducers are located according to the following equation:

$$v=L/2*t1-t2/t1t2$$

If required, the speed of sound (*c*) in the transmission material in question can be found from the same two measurements:

$$c=L/2*t1+t2/t1t2$$

5. Conclusion

While conventional flow meters are not good to use at remote places this portable battery powered flow meter we can easily use at remote location.

6. References

1.L.Svilanias,P.kabisius,Ultrasonic transit time flow meter for diesel: initial analysis,ISSN S1392-2114 ultrasound, NOV 4, 2010.
2. Yeh, T.T. ; Espina, P.I. ; Osella, S.A. Instrumentation and Measurement Technology Conference, 2001. IMTC 2001. Volume: 3 DOI: 10.1109/IMTC.2001.929499 Publication Year: 2001 , Page(s): 1741 - 1746 vol.3
3. www.morganelectroceramics.com
4. www.acam.de
5. www.Badgerflowmeter.com
6 .www.Electronet.com

