International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

Review on Design and Development of Low Cost Electromagnetic flow meter

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Abstract - *There is a need of efficient and a low cost method for metering of water as world is facing severe scarcity of it. Industrial processes mostly employ Electromagnetic flowmeters for measurement of flow rate of water but for domestic purpose mostly flow measurement can be done using Hall Effect water flow sensor. The Hall Effect water flow sensor can be considered as a low cost alternative with user friendly interface.*

***Key Words*: Electromagnetic flow meter, Flow Measurement, Hall Effect sensor.**

1. INTRODUCTION

The Electromagnetic flowmeter is an instrument that measures direct, nonlinear, volumetric flow rate of a fluid or a gas inside a channel or cylinder. The accurate flow measurement is a critical need in many industrial, domestic, irrigation applications. In certain tasks the capacity to direct exact flow measurements is significant .There are cases in which off base flow measurement or inability to take measurements can cause genuine as well as even grievous outcomes. With most fluid flow measurement instruments the flow rate is determined indirectly by measuring the fluid velocity or the change in kinetic energy .Velocity relies upon the weight difference that is constraining the liquid through a channel cross sectional area is known and stays steady, the normal velocity means that the flow rate. Different components that affect fluid flow rate are the liquids viscosity and density and the friction of the liquid in contact with the channel dividers. Generally this specific equipment includes the differential pressure, positive displacement, velocity and mass meters .With the measurement of velocity we can measure the volumetric flow rate as they are linearly related to each other. Reynolds number affects performance of flow meters.

The essential requirements for flow measurements are,

- Calibratability Of Measurements
- High Precision
- Capability to integrate flow fluctuation
- Fast fitting with piping device
- Less Expensive
- High Return ratio
- No movable component or element
- Loss of low pressure
- Corrosion and Degradation resistant.

2. LITERATURE SURVEY

Luis Castalier et. al describes structure and creation of a low cost water flow meter which can measure up to 9 liter/minute, staying away from direct contact of flow with silicon sensors [1]. Procedures of estimating water flow rates with the assistance of neural systems had additionally been proposed. Shiqian Cai and Haluk Toral proposed a procedure of estimating flow rate in Air-Water Horizontal Pipeline with the assistance of Neural Networks. Kohonen self organizing feature map (KSOFM) and the multi-layer back propagation network (MBPN) were applied in a hybrid network model to quantify the flow rate of individual stages in flat air water flow [2]. Santhosh K V and B K Roy (2012) had developed Ultrasonic Flow Meter with optimized neural network. The goal of this work Include to expand the linearity scope of estimation to 100% of the input range, to make the Estimation framework versatile to varieties in pipe diameter, fluid density, and fluid temperature, and to accomplish the over two goals by an Artificial Neural Network[3]. Youthful Woo Lee et. al proposed wireless digital wireless Digital Water Meter with Low Power consumption for Automatic Meter Reading in which they used magnetic hole sensors to calculate the amount of water consumption and they had used ZigBee wireless protocol to transfer amount of water consumption to the gateway [4]. The auxiliary fluid flow meter is developed by Javad Rezanejad Gatabi et. al in which the flow of an auxiliary fluid is measured, instead of direct measurement of the main fluid flow. The auxiliary liquids infused into the primary liquid and with estimating its movement time between two unique positions, its speed could be determined [5]. Zhang Wenzhao et. al proposed a liquid differential pressure flow sensor for Straight Pipe. In this framework a pressure difference between the upstream branch pipe and the downstream pipe is detected and converted into a voltage signal by the DP sensor. This voltage signal is transmitted to a microprocessor to determine liquid flow rate [6].The Microcontroller-Based Water Flow Control System develops by Thwe Mu Han, Ohn Mar Myaing .In this system, as detecting unit, photograph interrupter and slotted disk are used to create pulse train for frequency input of the microcontroller. This signal is converted into flow rate by software program in PIC [7]. Ria Sood, Manjit Kaur, Hemant

Lenka proposed design and development of automatic water flow meter. The main aim of this paper is developing a low cost flow meter model for measuring the flow rate through the irrigation pipe lines [8]. The different problems associated with water distribution plants such as leakage management, demand management, asset management, and so on identifying by Parag Kulkarni and tim Farnham [9].The Electromagnetic flow meter by Yukio Sai, Yousuke Kubota describes, the electromagnetic flow meter generates a magnetic field perpendicular to a hoop earth electrode contacting fluid at a cease part of a measuring tube and a factor electrode attached to a decrease part of them ensuring tube with a purpose to measure a flow rate without relying on a fluid level [10]. The electromagnetic flow meter with an excitation signal as a square wave is recommended by Mannhaz E Riester H [11]. The square wave excitation current is provided to an excitation loop is suggested by Toyofumi Tomit. An attractive field produced in this loop is intrigued by an electrically conductive liquid. The voltage prompted in the electrically conductive liquid is drawn out as a flow rate signal by means of a pair of electrodes. The issue of the flow rate signal is postponed by the example hold circuit to a degree relating to a large portion of the time of the flow rate signal [12]. A signal generator for an electromagnetic flowmeter gave a flow tube having a protected liner through which a liquid to be metered streams to capture an electromagnetic field built up in that to initiate a sign contingent upon stream rate in a couple of terminals mounted at oppositely contradicted positions on the tube recommended by Toshio Sekiguchi [13]. Jimmie W. Hamby, Hubert S. Pearson suggested that an improved flowmeter framework is depicted, along with hardware, equipment, and methods for its usage for deciding the rate of flow of liquids in conduits at a situs considerably remote from the data social affair and examination situs [14]. N.R Kolhare, P.R Thorat Developed a Solar Water Heater Flow estimation utilizing small scale controller based Turbine Flow Meter will supplant the other customary framework utilized in Solar Water Heater flow estimation This framework kills the manual slip-ups in flow rate estimations. It expands the exactness in flow rate estimation. This framework is progressively alluring, as it gives programmed activity; hands-free, long-range distinguishing proof bolsters, just as spread checking applications. Likewise can be utilized for various consistency fluids just by changing multiplication factor Sensors planned in the created framework are extremely financially savvy and precise [15]. Ganesh Nazare, Swapnil Hatte, Amit Gavali and Santosh Rajgade design and fabricated the accurate flow measuring system parameters and to make it more reliable. It is important to the accurate measurement of the flow parameter to have decent control on the framework. In order to take this control, they have designed their own framework which can coordinate the industrial standard of a Flowmeter [16].

These papers describe design and modelling of electromagnetic flow meter with homogeneous magnetic field and effective velocity of fluids on induced voltage. Likewise portrayal of activity of EM flow meter, impacts of liquid conductivity coefficient and compelling of the liquid level in pipe on actuated voltage. This paper describes a smart low-cost remote-monitoring flow sensor designed for the developing country context. The sensor uses low-cost off-the-shelf sonar devices to gauge river height as a proxy for flow rates and works through an Internet-of-Things (IoT) hub dependent on the Global System for Mobile Communications (GSM) standard.

3. CONCLUSION

The most important feature of any flowmeter is to measure the accurate flow rate. This paper gives reviews of different design and development of electromagnetic flow meter. The Electromagnetic flow meter principle is relay on Faraday's Law. This paper is very much helpful for the study of existing system to design and development for electromagnetic flowmeter.

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