Enhanced Solar Based Water Flow Meter using Wireless Technology

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Abstract – To effectively manage and save energy and natural resources, the measurement and monitoring of gas/fluid flows play extremely important roles. Three major technologies have made this possible: a low power consumption metering unit, a cog-resistance-free generator with high efficiency; and an effective methodology to extract/store energy. The main aim of this project is to provide the accurate and proper readings to Bhusawal Thermal Power Plant by making self-powered, wireless system & counting units, water consumed solar based water flow meter using GSM technology. As irrigation department sends the information in respect to readings and amount of water used by the plant but due to analog type of flow meter which is also far away from the plant it is difficult to get accurate readings and thus enhancing flow meter using solar power and wireless technology. This solar powered flow meter consumes less power which requires zero human efforts by using wireless digital flow meter. This flow meter uses PIC microcontroller and flow sensor and Max-232 Ic which is used for converting the signals from the RS232 serial port to the proper signal used in the TTL compatible digital logic circuits. Test results conducted within 15 meters distance between the RF transceiver to send and receive data from micro controlled-digital water meter. As the results, the average accuracy of water meter is 1.58% that has proven the water flow sensor accuracy is within the range of ±3%. The reliability and durability of the rechargeable batteries are proven can support the system for 16 hours without sunlight present. The package loss has increased when the distance becomes longer

Keywords: Microcontroller PIC18F4431, Transistor-transistor logic (TTL), Global system for mobile communication (GSM), Integrated Circuits (Ic)

INTRODUCTION

A flow meter is a device used to measure the flow rate or quantity of a gas or liquid moving through a pipe. Flow measurement applications are very diverse and each situation has its own constraints and engineering requirements. Flow meters are referred to by many names, such as flow gauge, flow indicator, liquid meter, etc. depending on the particular industry; however, the function, to measure flow, remains the same.

Flow measurement is the quantification of bulk fluid movement. Flow can be measured in a variety of ways. Positive-displacement flow meters accumulate a fixed volume of fluid and then count the number of times the volume is filled to measure flow. Other flow measurement methods rely on forces produced by the flowing stream as it overcomes a known constriction, to indirectly calculate flow. Flow may be measured by measuring the velocity of fluid over a known area. For very large flows, tracer methods may be used to deduce the flow rate from the change in concentration of a dye or radioisotope.

A flow meter, is an instrument for measuring the volume, mass, or velocity of gas or liquid flowing through piping. While most flow meters are designed for either gases or liquids, some models can be used with both. A flow meter for gases is commonly referred to as an air flow meter, while one for liquids is commonly referred to as a water meter or water flow meter. Flow meters are available with an analog scale, a digit counter, or a digital readout, and some have a signal output that transmits data to a remote device. They are used in applications such as water treatment, utilities monitoring, manufacturing, food processing, mining, refining, and medical research.

Among the factors to consider when selecting a flow meter are the type of measurement being made (volume, mass, or velocity), the type of media (liquid or gas) being measured and its compatibility with the meter's

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wetted parts, the required flow range and accuracy, and the pressure rating. Certain meters can handle slurries and media with particulates, while a water meter may only be compatible with clear liquids. Most flow meters have pipe fittings for inline installation; the type and size of the fittings varies from meter to meter. A flow meter may be immersible or have fittings for panel mounting.
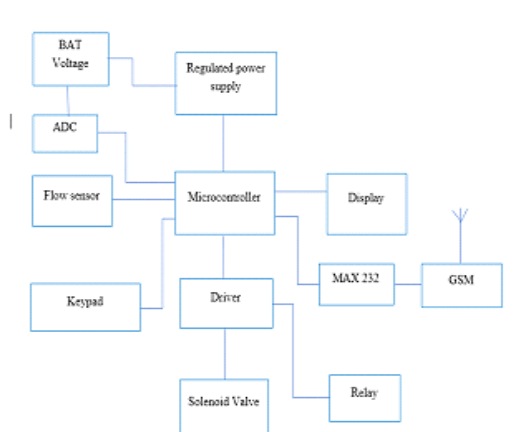
There are various types of flow meter as a variable area flow meter, or rotameter, has a tapered tube and a float that indicates readings on an analog scale. It is mainly used for liquid flow measurements and is available in models for horizontal or vertical mounting. An ultrasonic, or Doppler, flow meter uses sound waves to measure the velocity of liquid flow. Thermal mass flow meters heat gas or liquid at one point within a pipe and have a temperature sensor to measure heat loss as the media moves through the pipe. Turbine flow meters determine volume by counting rotations of the rotor as liquid flows through the blades of the turbine. Low flow rate meters are often used for fuel monitoring in engines.

As the world is becoming more encompassed with smart technology we are seeing a gradual shift from smart phones to smart homes. This is making conventional water meter monitoring less of a necessity because of all the manual steps required when locating and learning how to read it. We have found that most wireless water meters track the water use more efficiently but the display of the use is located somewhere in the industry & business.

This makes wireless water meter monitoring much more efficient for the user since they can do this by their phone and even when they're away from industry.

METHOLOGY

Block Diagram

Microcontroller:
The microcontroller in flowmeter is used to count the pulses sent by the flow sensor, timer issues and serial communication.

Driver:
The driver is used to connect solenoid valve and relay used in the system to the microcontroller.

Solenoid valve:
A solenoid valve is an electromechanical actuated valve to control the flow of liquid. It consists of an electric c oil with a movable ferromagnetic core (called as plunger). While in rest mode the plunger closes an orifice. A magnetic field is generated when current is passed which exerts force on the plunger and the orifice opens.

Relay:
Relay provides the switching action needed to facilitate the flow of electric current in solenoid valve which will then decide if the orifice is open or close.

MAX 232:
Max-232 Ic is used for converting the signals from the RS232 serial port to the proper signal used in the TTL compatible digital logic circuits.

GSM:
GSM module for wireless communication, to send the notifications regarding the status of flow measurement to the organization to avoid manual labor.

Flow sensor:
Water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow. The hall-effect sensor outputs the corresponding pulse signal.

ADC:
An Analog to digital converter is an electronic device which converts varying analog signals into digital signals so that they can easily be read by the digital devices.

Regulated power supply:
A regulated power supply converts AC supply into DC. Its function is to supply a stable voltage to a circuit or device that must be operated within certain power supply limits.

CONCLUSION

This paper presented the design of a solar powered, GSM facilitated water flow meter. These modifications help solve the problem of accessibility faced by organizations that draw water from water bodies located in dense areas. Solar panels help retain the power even in unfavourable weather conditions by storing charge for upto 2 days. The wireless communication enables the organization to monitor the flow of water without without frequently visiting the site.

Flow meter can replace the other high cost water flow measuring meters available in the market.

This system eliminates the manual mistakes in flow rate measurement. Also it is more accurate in comparison to other types of meters. This system is more attractive, as it provides automatic operation with great accuracy .

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