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Smart Meter for Water Utilization using IoT

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ABSTRACT - *Smart water meter is a device that measures the amount of water consumed by householders who have the device fitted within their premises. Water conservation is a big issue in many apartments. A common meter is fitted and cumulative consumption amount is shared among households where they are being charged more than what is to be paid. There are several idea to overcome this issue. In this paper we have proposed a solution to this issue in which a device is used to calculate the flow rate and quantity of water consumed by the householders and send it to the cloud to monitor the consumption of water.*

Key words: water flow sensor, flow rate, NodeMCU microcontroller, smart water meter, water consumption

INTRODUCTION

IoT(Internet of Things) is defined as a system where physical objects can become active participants and services are available to interact with these objects over the internet. It enable the devices that can communicate and network with each other and with the environment by exchanging information via the internet with or without human intervention. Smart water meter is an internet-capable device that measures the amount of water consumption in a building or home. Now a days, water conservation is big issue in many apartments. Apartment association should take initiative to send the message of the amount of water consumed to all residents. In this paper we proposed the solution for the above issue by installing the smart water meter for every house in apartment to monitor the consumption level of water using IoT technology. The another problem is where a common meter is fitted in complex and bill for cumulative consumption amount is to be shared among the households, where they are being charged more than what is to be paid. So they need a system under which charges are levied as per consumption of each family instead of total cumulative consumption. Smart meter for water utilization provides solution for this problem and it measures the quantity of water consumed by each household and allow the user to monitor the consumption level. While installing this smart water meter we should avoid above issues and we should keep track on the water consumed over the internet. The supply of water can be ended if the residents are not present in their home and it reduces energy consumption directly or indirectly.

RELATED WORKS

Gurung Ram[1] proposed a paper that demonstrated how smart metering and provide better handling the demand complexities of contemporary water supply methodology developed by smart meter. It focused on optimal planning of water infrastructure network.

G Hauber-Davidson[2] proposed a paper that discussed role of smart water meter and working of smart meter and shown the water consumption in real time. He proposed an idea to took the action when increasingly expensive water.

Sarah Darby[3] proposed an idea of affordance and using this theory of affordances, qualitative research is examined to understand how householders had used consumption feedback, with and without smart meters. Advanced Metering Infrastructure (AMI) relied in the transition to lower-impact energy systems. AMI offered possibilities for household energy management and customer–utility relations.

Tracy C. Britton[4] shared his idea about water utilities to improve water distribution System and reduced the amount water lost in the network. It estimated the customer post meter leakage for up to 10% of total water consumption and concluded that reduced the water loss by finding post meter leakage.

E.Idris[5] proposed a paper about Intelligent Water Metering(IM) which offered the potential to transform the urban water management. This paper was to provide an overview of prospect and pitfalls based on review of IM deployment.

Cara D.Beal[6] proposed a paper that had shown that householders' perceptions of their water use were often not well matched with their actual water use. This paper examined the contributions of end users to total water use for each group that self-identified as "low", "medium" or "high" water users. The consumers received level of information based on their water bill.

Fernando Arbues[7] insisted by explaining a paper which focused on household size. They had estimated a residential water demand function which includes multiplicative dummy variables that enables them to analyze if users'

sensitivity to changes in price is different depending on the number of household members.

Rodney A[8] demonstrated paper about the potential role of smart metering for the future of water planning. Smart meter had a capacity to deliver data to residents about the water use, to translate this data, a Web-Based Knowledge Management System (WBKMS) is proposed, which integrates smart metering, Wireless communication networks and information management Systems. This information can be access online by customers.

Graham Cole[9] proposed a paper about the implementation of a smart water metering system in Hervey Bay allowed the local water utility to record the hourly water consumption of all its customers. It provide detailed result of the analysis of average hour, peak hour, peak day and peak month consumption data.

Damien P[10] proposed a paper that highlighted three aspects associated with the introduction of smart metering technology which require further consideration—potential conservation benefits for consumers and utilities, the potential for streamlined business management and pricing based on time of use, contrasted with the real risk of consumer privacy breaches which requires further input and discussion from all stakeholders.

PROPOSED METHODOLOGY

In this paper we proposed the solution for water utilization using water flow sensor and interface with Node MCU microcontroller which embedded with Arduino code. Arduino software is used for Arduino coding to find flow rate of water, display the output in serial monitor and send the sensed data to the cloud which can be monitored by customers.

A) Hardware Needed

1) Node MCU microcontroller

A Node MCU has 10 bit ADC which means it scales an analog signal in a range of 0-1023.It has an inbuilt serial monitor that allow to take serial input and output from the Node MCU, while Node MCU is in action. It has inbuilt Wi-Fi. So that we can easily send sensed data through Wi-Fi module. Node MCU is cost effective.

2) Water Flow Sensor

Water flow sensor is used to take a note of how much water has been transferred from one area to the other. It consists of a plastic valve body, a water rotor and a hall-effect sensor.

B) Software Used

Arduino IDE is used to generate the code and upload the code on microcontroller for Implementation and Testing.

C) Working of Water flow sensor

When water flows through the rotor, the rotor start rolling after feeling the pressure. Its speed changes with different rate of flow. The hall-effect sensor outputs the corresponding pulse signal.

The Hall Effect is utilized in the flow meter using a small fan/propeller shaped rotor which is placed in the path of the water flowing. The water pushes against the fan of the rotor, causing it to rotate. The shaft of the rotor is connected to a Hall Effect sensor. It is an arrangement of a current flowing coil and a magnet connected to the shaft of the rotor, thus a voltage/pulse is induced as this rotor rotates. In this flow meter, for every liter of water passing through it per minute, it outputs about 4.5 pulses Calculate the flow rate in liters per hour (L/hr) using a simple conversion formula

Water flow rate is **Q=VxA**,

Where,

Q is flow rate/total flow of water through the pipe,

V is average velocity of the flow and

A is the cross-sectional area of the pipe

Pulse frequency (Hz) = 4.5Q, Q is flow rate in Liters/minute

Flow Rate (Liters/hour) = (Pulse frequency x 60 min) / 4.5Q

D) Microcontroller connection with flow sensor

The minimal connections required for this flow rate sensor with respect to Node MCU. There are only three wires coming from the flow rate sensor the 3V Vcc (Red wire), the GND (Black wire) and the signal/pulse (Usually yellow) line. Connect the Vcc and GND of the flow meter to the node McU‟sVcc and GND. The signal/pulse wire is given to any one digital input of Node MCU to show the digital output on serial monitor.

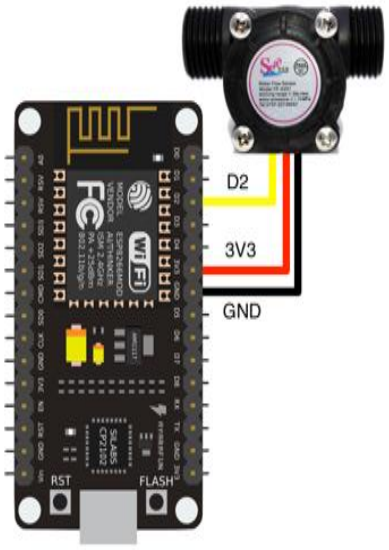


Fig:1 Node MCU connection with water flow sensor

Let us consider two Water flow sensors that made connection with microcontroller and Assume that each one is fitted with two different houses. Another ends of two Water flow sensors are connected with Water tank. The water from water tank passed through these sensors which measure volume of water flew to each house.

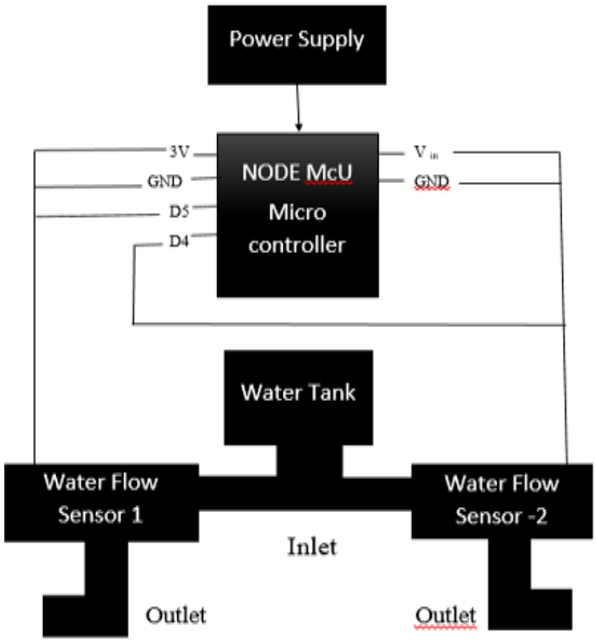


Fig: 2 Block diagram

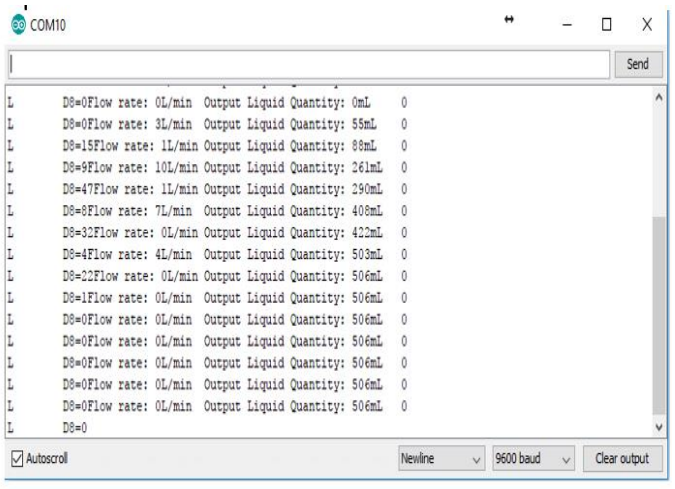
```
// Initialize a serial connection for reporting values to the host
Serial.begin(9600);

// Set up the status LED line as an output
pinMode(led, OUTPUT);
digitalWrite(led, HIGH);  // We have an active-low LED attached

pinMode(spin, INPUT);
digitalWrite(spin, HIGH);
oldTime=0;
flowMilliLitres=0;
totalMilliLitres=0;

attachInterrupt(sinterpt, pulse, FALLING);

void loop() {
  thing.handle();
  count=0;
  sei();
  delay(1000);
  cli();
  flowrate=  ((1000.0 / (millis() - oldTime)) * count) / cf;
     oldTime = millis();
    flowMilliLitres = (flowrate / 60) * 1000;
totalMilliLitres += flowMilliLitres;
Serial.print("Output Liquid Quantity: ");
    Serial.print(totalMilliLitres);
    Serial.print("mL");
    Serial.print("\t");
```



E) Experimental Analysis

There are several cloud Platforms available in Internet with which the data is sent to the cloud using Wi-Fi and the users can monitor the output (Flow Rate) that is displayed in the form of graphical Representation.

REFERENCES

[1]. Gurung, Ram, Stewart, Rodney, Beal, Cara, K. Sharma, Ashok" Smart meter enabled water end-use demand data: platform for the enhanced infrastructure planning of contemporary urban water supply networks" Published at Journal of Cleaner Production, 2014.

[2]. G Hauber-Davidson, E Idris," Smart Water Metering", Published at journal of Water, 2006.

[3]. Sarah Darby, "Smart metering: what potential for householder engagement? "Published at BUILDING RESEARCH & INFORMATION,UK,2010

[4]. Tracy C. Britton a, Rodney A. Stewart b, *, Kelvin R. O'Halloran c," Smart metering: enabler for rapid and effective post meter leakage identification and water loss management Tracy" Published at a Journal of Cleaner Production, 2013.

[5]. Idris, E. "Smart Metering: A Significant Component of Integrated Water Conservation Systems." In Proceedings of the 1st Australian Young Water Professionals Conference, Sydney, Australia, 2006.

[6]. Cara D.BealRodney, A.StewartKellyFielding"A novel mixed method smart metering approach to reconciling differences between perceived and actual residential end use water consumption" Published at Journal of Cleaner Production,2013,

[7]. Fernando Arbués, InmaculadaVillanúa, RamónBarberán, "Household size and residential water demand: an empirical approach" Published at the Australian journal of agriculture and resource economics,2010

[8]. Rodney AStewart, RachelleWillis, Damien Giurco, Kriengsak Panuwatwanich & Guillermo Capati, "Web-based knowledge management system: linking smart metering to the future of urban water planning ", Published at journal of Australian planner,2010

[9]. Graham Cole and Rodney A. Stewart1." Smart meter enabled disaggregation of urban peak water demand: precursor to effective urban water planning", Published at Urban Water Journal, 2013.

[10]. Damien P.Giurco, Stuart B. White and Rodney A.Stewart ," Smart Metering and Water End-Use Data: Conservation Benefits and Privacy Risks" Published at journal of water,2010