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Implementation of advanced 3 in 1 smart meter using GSM module

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Abstract

Due to the COVID-19 pandemic, humans confronted the problem with electrical billing Machine. The system generated billing gadget is set in this sort of way that its far taken either month-to month/bimonthly. But, this time the bill has been generated after 65 to 67 days due to COVID-19 lockdown. So there has been a soar inside the slab costs, this made customers to be charged greater than what's to be paid. To overcome this problem, proposed advanced 3 in 1 smart meter utilizing GSM. This paper aims at timely measurement of electricity, gas and water in smart way, Whose objective is to gather the meter perusing consequently sending messages from the Modem to remote mobile phone where the process of noting down the meter readings is easier and accurate. Besides, the consumer can access the notification regarding the scenario with power from any place. GSM recipient consists of data set that functions as a charging point that is connected to a system from the opposite end. Occasionally from the GSM empowered energy meter's pursued live meter is directed back to the charging point. Proposed system measures electricity as well includes a water and gas billing system. The framework exhibited its ability to monitor the Energy utilization, send the notification to

the mobile phones when the breaking point is approached, using effectively by rebooting, just by getting to a GSM-based cell phone.

Keywords: GSM-based energy meter, GSM-based Water billing meter, Gas Leakage Detection, Automatic meter reading (AMR).

1.1 Introduction

Life's content is maintained by an indispensable requirement that is electricity. For around 10 years advanced energy meter innovations have been explored. Over the decades, a lot of advancements took place that decreased hefty and complex meters to simple measuring and billing meters by improving highlights, determination [1]. Nowadays, due to the immense distinction in energy creation and utilization, energy consumption and energy conveyance have gotten a major subject for conversation [2]. Then again, customers are likewise not happy with the administrations of force organizations [3]. More often than not they have grumblings in regards to factual mistakes in the month-to-month bills. Advanced precise billing smart meter scan undoubtedly take readings, significantly decline the bill of a client by cautioning the client with an alarm message prior to multiplying the unit charge and lessen the squandering of force. At present, the meter consists of a round about metal strip that pivots and as per that revolution; energy consumption is calculated. But, the consumption of energy is the main working of the meter. With this are aiming to get the month-to-month energy utilization from a distant place to an incorporated office [4]. Along these lines, we can decrease the human endeavors expected to record the meter readings which are recorded by visiting every home exclusively till today. It's difficult to screen the changing most outrageous interest of users in the circulation organizations of the current billing system. The user is confronting issues like getting due bills for charges that have effectively been paid just as helpless dependability of power supply and quality regardless of whether the bills are paid consistently. The solution for this load of issues is to monitor the customer's heap on a convenient premise, which will have held to guarantee exact charging, track the greatest interest, and checking set value [5-9]. These are generally the features to be considered for arranging a capable energy charging framework. Similarly, Water distribution and its control over the billing cycle is one of the most challenging tasks for the government [10]. Municipal Corporation. Water Distribution System is a manual system and it is difficult to monitor the consumption of water centrally. The existing

system fails to monitor the quantity of water. This proposed system i.e., the advanced 3 in 1 smart meter is fully automated. Where it receives real-time data of consumption and can control the valve to restrict the flow of water. Consumers can interact with the mobile application to monitor the usage and for payment of bills or to stop or start the service. And these water meters are connected via GSM which will take the data from that meter and send it to the server. It also consists of Flow Sensor, Micro controller [11, 12, 13], and GSM module. This system enables respective departments to access the meter recordings monthly, avoiding the traditional practice. The value will be set previously; when this value gets closer the user receives the message of alert in a verbal format via GSM.A Smart Meter works by estimating the electrical flow stream and voltage at standard stretches and afterward adding this up to ascertain the force Ute- lazed savvy Meter works by estimating the electrical flow stream and voltage at ordinary spans and afterward adding this up to figure the force utilized. Additionally, for gas, the stream is estimated at customary stretches. This information can be seen on your mobile application and sent to your supplier. This meter not only calculates the consumption of gas but also detects and prevents the leakage of gas. Various communications technologies might be utilized in various types of premises for the Home Area Network to convey and various advances will be utilized in various pieces of the nation to permit the Wide Area Network to send information to and from the organization giving the correspondences.

1.2 Methodology

The current framework presents another technique for Programmed meter perusing electronically and communicating to base camp for additional handling and consumers. This aids in lessening the human mistakes that happen in the current meter perusing frameworks blend of both technologies: GSM networks and embedded systems. The proposed system consists of three main components: Electricity, Water and Gas. Allow us to think about an illustration of Electricity; here we are associating the Energy Meter between main supply and load, by which Microcontroller will be able to measure the energy units consumed by the consumer. When the various appliances of the household consume energy, the energy meter reads the reading continuously and this consumed load can be seen on meter. We can see that the LED on meter continuously blinks which counts the meter reading and observed that the LED of the meter constantly sq units , which checks the meter perusing. The units are checked based on the number of times it blinks. Typically, 3200

flickers are one unit. In this task, we are attempting to create, a framework where PIC16F877A goes about as the fundamental regulator, which constantly monitors the advanced building meter. According to the flickering of the LED on this meter, the PIC16F877A will gauge the unit utilization. The deliberate perusing with the estimation of the expense will be consistently shown on the web that we have developed. Communication medium depends on the current GSM network. The Meter billing and control operations will be performed simply using the Short Messaging System service that is available over GSM. For this, no alteration or even customization is required in the actual network. The threshold value can be set according to the user's necessity. At the point when the users perusing will be close reaching the set edge esteem it's anything but a warning worth to the customer Via GSM. Above limit, esteem warning builds mindfulness among the buyer about this energy. Similarly, Gas and flow meters are used to check how much amount of gas and water has been used based on that bill has been generated. The Micro controller processes the measure of energy, water, and gas burned through. Then, at that point, the determined quantities are sent immediately by means of GSM to the main station and the essential updates are performed.
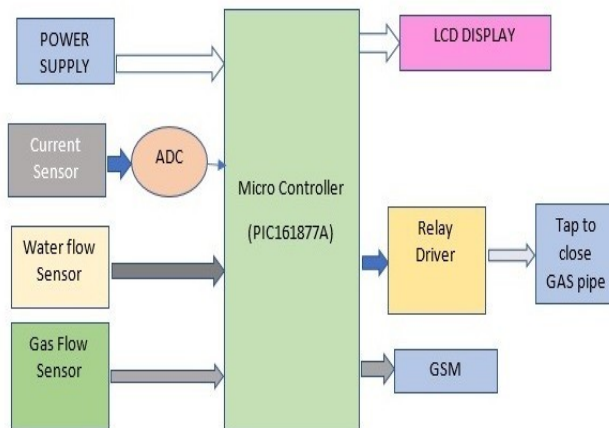
1.3 Block Diagram

Figure 1.1 Block Diagram of the proposed system.

The micro-controller used in this is PIC16f877A to which the power supply is connected. The current sensor, water flow sensor, and gas sensor are

connected to the micro controller, where the current sensor is connected via ADC. Once the operation takes place the reading of the current, water, and gas is displayed on the LCD which is again connected to the micro controller, when there is a gas leakage, the gas sensor will detect and send it to the micro controller, where the relay driver helps to increase the voltage and closes the tap of gaspipe , all these information will be sent to the mobile phone via GSM. Fig 1.1 shows the block diagram of the proposed system.
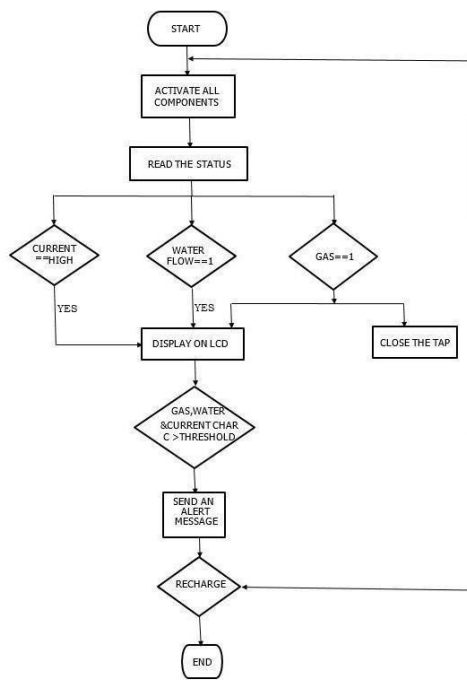
1.4 Flowchart

Figure 1.2 Flow Chart of the proposed system.

In fig 1.2, it explains the working of the system. The system starts and activates all the components as soon as it is switched on. It reads the status, if the electricity, water, and gas are higher than the previously set threshold value then it will be displayed on the LCD and also sends an alert message to

our phones via GSM if it exceeds the set values the flow of the current, water, and gas will stop. If the gas leakage is detected it will close the pipe.

1.5 Hardware Components

Table 1.1 Specification of the Components

Sl. No	Components	Specification
1	PIC16F877A	Operating voltage : 2 to 5.5 Program Memory: 14KB CPU Speed (MIPS): 5 MIPS RAM Bytes: 368
2	Power supply	Output voltage: 12 V
3	Gas sensor	Detection Range: 100 - 10,000ppm Fast Response Time: ¡ 10s Heater Voltage: 5.0V
4	LCD	Display: 16×2 characters Operating Temp : (0-5 0C) Power supply: 5.0 V
5	Water Level Sensors	Voltage Range: 5 to 18V DC Max current draw: 15mA at 5V Flow Rate: 1 to 30 Liters/Minute. Max water pressure: 2.0 MPa
6	Current sensors	Supply Voltage: 4.5V 5.5V DC Measure Current Range: 30A 30A Sensitivity: 100mV/A.
7	GSM Modem SIM 300	Operating Voltage: 7 15V

1.6 Software Components

In this paper, we have used embedded C programming and MPLAB IDE, and PICkit 2 software.

1.7 Results

The paper aims at, generate billing system and notify the status of electricity, water, and gas. The electricity bill will be generated automatically every month and will be updated to the concerned department through GSM and

the bill generated will be sent to consumers through SMS. Similar to the electricity bill the water and gas bills are generated. The amount of water consumed by the customers will be recorded in the meter and the meter sends the information to the concerned department through GSM and they, in turn, send the bill to the consumers. Currently, in most parts of India, the gas will be delivered in cylinders to the consumers. In the coming future, gas pipelines will be established similar to water and the gas will be delivered through these pipes. Then the consumption of the gas must be recorded using a meter. So, this advanced meter is automated to send the gas usage details to the concerned department and they in turn send to the consumers through GSM. Another advantage of this advanced meter is the detection of gas leakage in the pipelines and taking preventive measures before the issue gets serious. System facilitates inbuilt prepaid billing system for future, Where the supply can be stopped immediately as and when the amount is over. Fig 1.3 shows the hardware set up of advanced 3 in 1 smart meter and fig 1.4 shows the message delivered to consumer notifying the status of recharging, running out of cost, renew electricity bill and gas leakage detected.
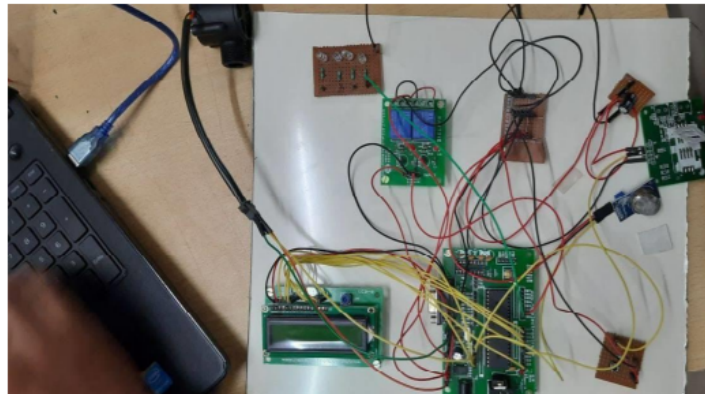

Figure 1.3 Proposed hardware system

1.8 Conclusion

The proposed system considers the existing issues and builds an efficient and effective advanced 3 in 1 smart meter for generating electricity, water and gas bill automatically every month and will be updated to the concerned department through GSM and the bill generated will be sent to consumers
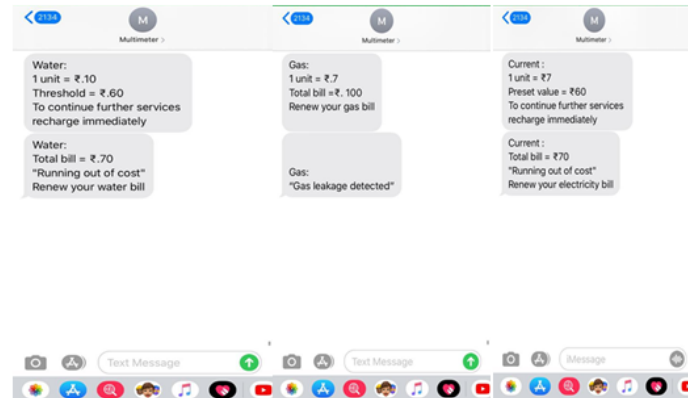
Figure 1.4 Message delivered to consumer

through SMS. This metering system enhances the efficiency and effectiveness and timely data availablity to consumer. Along with this, Detection and Prevention of Gas Leakage are also carried out as an additional necessity by the system. To conclude that, there can be no conclusion to the human race's constant striving for Excellence and the evolution of technology. The future advancements of this unassuming thought of our own can be the acknowledgment of a solitary chip arrangement that will impregnate inside itself a force re-estimating unit, alongside a GSM-based module. This will not only reduce the size of the meter but will also make it more robust and commercially available. The tedious job of Energy Management at each sub- station can also be simplified by using this smart metering system, the conglomerated the modern technologies of SIM cards and meters into a single unit believing that this will revolutionize the power scenario in our country.

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