

Unified Meter for Electricity, Gas and Water with Automatic Billing and Payment

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Abstract - Every month it is seen that there are three bills generated for the consumption of the basic necessities like electricity, gas and water we use on a daily basis. The proposed system measures the consumption of all these resources and provides a unified billing and payment system for it. This has two sub-systems consisting of a sub-system for measurement and the server-controlled sub-system for data storage and analysis. Communication between these two sub-systems is done through wireless network. This system monitors the consumption of electricity, water and gasoline resources. The amount of resources consumed is updated in the server, and a consolidated bill is generated. Every user will be provided a mobile application where the billing details are updated on a monthly basis with a portal for payment. This process is achieved by using the concept of embedded system and IoT.

Key Words: Iot, Embedded-systems, Unified-billing, Sub-system, Wireless-network.

1. INTRODUCTION

Due to modern busy life, it is stressful and difficult to remember the different yet simple task of settling the bill for the utilization of the provided services. Among these, the major ones are settling the bill for the consumption of electricity and water which is periodic for every month. To meet the growing city demand, there will shortly be a provision of the LPG through pipelines to each and every house in the city, which will add on to every growing list for bill settlement. Using the concept of Embedded Systems and IoT, the burden of the citizens can be reduced by introducing a device which measures the consumption of electricity, water, and LPG per month for the given house and also calculates the total amount which is to be paid by the customer to the respective authorities. The unified bill thus generated will have the details regarding the usage of all the three services and the total and, individual cost due to pay that month.

2. LITERATURE SURVEY

[1]In the paper "Analysis of Smart Meter Data for Electricity Consumers" the authors Grzegorz Dudek, Anna Gawlak, Mirosław Kornatka and Jerzy Szkutnik document about how smart meter systems are being deployed to improve grid reliability and promote energy, water, and gas efficiency

while providing improved services to their customers. Smart metering which is installed in millions of households worldwide provides utility companies with real-time meaningful and timely data about electricity consumption and allows customers to make informed choices about energy, water, and gas usage. Smart meter data analytics has become an active area in research and industry. It aims to help utilities and consumers understand electricity consumption patterns. This paper provides analysis methods for load data including analysis of daily load profiles and similarity between them, analysis of load density, and analysis of seasonal and irregular components in the load time series. We evaluate our approach by analyzing smart meter data collected from 1000 households in Poland at a 15-minute granularity over a period of one year.

[2]In the paper "Smart Meter for the IoT" the authors F. Abate, M. Carratù, C. Liguori, M. Ferro, and V. Paciello document about how in recent years, smart devices are increasing. These devices allow making cities smart, enabling communication not only among people but also among things, creating a new system nowadays known by the term IoT (Internet of Things). A smart city is based on a smart grid that allows to intelligently manage the power grid. In order to do this, the network must have intelligent meters that can communicate bi-directionally with the network. This market has led to a proliferation of smart meters that give the opportunity to measure the consumption of every single device in homes. The most part of smart meters is based on a chip that calculates the parameters needed to estimate energy, water, and gas consumption. In this paper, the authors consider a smart meter based on a common chip that calculates the power consumption and the meter characterization is reported.

[3]In the paper "Smart Energy, water and gas Metering and Power Theft Control using Arduino & GSM" the authors Visalatchi S and Kamal Sandeep K document about how the energy, water and gas theft is a very common problem in countries like India where consumers of energy, water and gas are increasing consistently as the population increases. Utilities in electricity system are destroying the amounts of revenue each year due to energy, water, and gas theft. The newly designed AMR used for energy, water and gas measurements reveal the concept and working of new automated power metering system but this increased the Electricity theft forms administrative losses because of not

regular interval checkout at the consumer's residence. It is quite impossible to check and solve theft by going every customer's door to door.

[4] In this paper, a new procedure is followed based on MICROCONTROLLER Atmega328P to detect and control the energy, water and gas meter from power theft and solve it by remotely disconnect and reconnecting the service (line) of a particular consumer. An SMS will be sent automatically to the utility central server through GSM module whenever unauthorized activities detected and a separate message will send back to the microcontroller in order to disconnect the unauthorized supply. A unique method is implemented by interspersed the GSM feature into smart meters with Solid state relay to deal with the non-technical losses, billing difficulties, and voltage fluctuation complication.

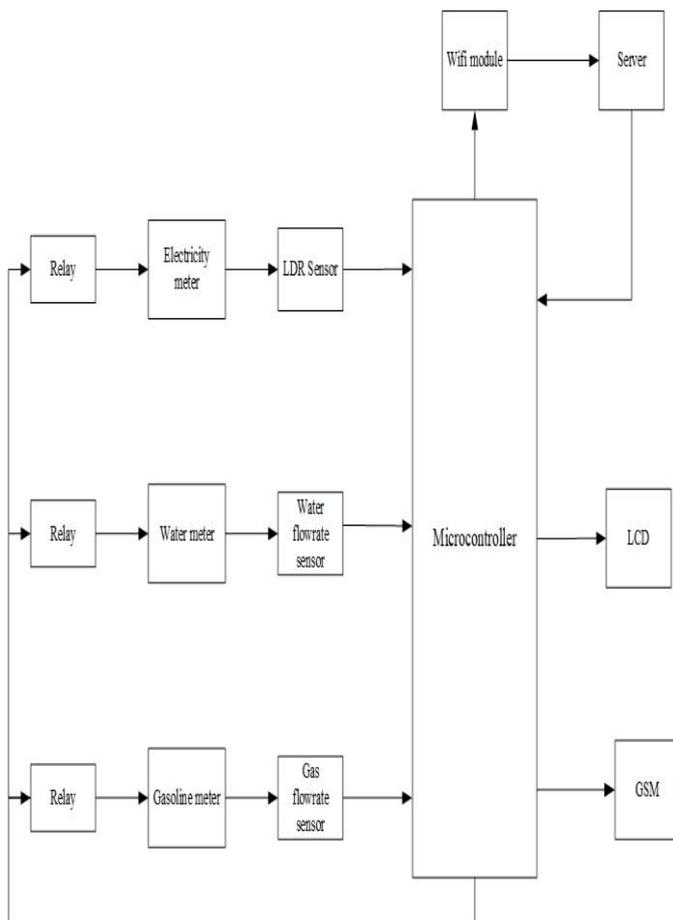
[5] In the paper "An anti-power theft method for secondary circuit of energy, water and gas meter current transformer" the authors Sitao Li, Jinqun Zhao, Jianzhi Liu, Zhibin Zheng, Jing Zhang and Lixuan Jia document about the present, power theft ways become increasingly subtle and intelligent. Power theft not only has caused a great loss to the nation and the power sector but also has brought serious security risks to the equipment and personal health. Although the power theft behavior of the energy, water and gas meter voltage transformer secondary circuit has been well recognized and effectively suppressed, the anti-power theft method for the secondary circuit of the energy, water and gas meter current transformer is still a weak link. Therefore, this paper proposes a transient method based anti-power theft method for the secondary circuit of the energy, water and gas meter current transformer. This method applied the pulse signal to the secondary circuit of the energy, water and gas meter current transformer first, then obtained the equivalent resistance and inductance parameter of the circuit by measuring the transient value of the circuit response current. Comparing these parameters with the original parameters of the circuit, we can judge the circuit state and power theft way. The simulation results verify the accuracy and reliability of the proposed method, which is a new anti-power theft method of the energy, water and gas meter.

[6] In the paper "Energy, water and gas Theft and Defective Meters Detection in AMI Using Linear Regression", the authors Sook-Chin Yip, Chia-Kwang Tan, Wooi-Nee Tan, Ming-Tao Gan, and Ab-Halim Abu Bakar document about

how electricity theft is always a ticklish problem faced by utilities around the world. To mitigate and detect energy, water and gas theft, utilities are leveraging on the consumers' energy, water and gas consumption dataset obtained from advanced metering infrastructure to identify anomalous consumption patterns. However, real energy, water, and gas theft samples, as well as the distribution station smart meter readings, do not exist in Malaysia because smart grid is not fully implemented. Therefore, we design and construct a small-scaled advanced metering infrastructure test rig in the laboratory to evaluate the performance and reliability of our previously proposed linear regression-based detection schemes for energy, water and gas theft and defective meters in small grid environment. Simulations and electrical tests are conducted and the results show that the proposed algorithms can successfully detect all the fraudulent consumers and discover faulty smart meters in smart grids.

[7] Security of the smart metering infrastructure, which is a part of the smart grid initiative, intended at transitioning the legacy power grid system into a robust, reliable, adaptable and intelligent energy utility, is an imminent problem that needs to be addressed quickly. Moreover, the increasingly intensifying integration of smart metering infrastructure with other ecosystem applications and the underlying communication technology is forcing both the consumer and the utility provider to meticulously look into the security and privacy issues of the smart grid. To achieve this, improvements on the existing architecture that uses smart meters interacting with smart grid is needed. This architecture would help in consolidation and aggregation of the energy usage and generation as intelligent communicators instead of focusing them as isolated passive units in the energy grid. The study presented in the paper analyses the various existing smart metering infrastructure, threats and vulnerabilities that has the potential to disrupt the operation and deployment of automation systems in smart grids. Furthermore, an elaborate study and subsequent analysis have been made on a live consumer meter setup in a non-invasive manner, which shows the various security loopholes and deficiencies of a large deployment of unattended smart meters. The study identifies the potential gaps and suggests possible measures for a cost effective and robust solution to cater for present as well as future needs.

3. BLOCK DIAGRAM



4. CONCLUSION

The smart energy, gas and water meter designed based on the requirements of electricity and water utilities is capable to measure and control the volume of water and the amount of energy simultaneously in a single package; thereby, it can meet the policy of monitoring energy/ water consumption. This is a user-friendly and straightforward solution that is economical and easy to install, maintenance free and tamper-proof. This system has indicated the most practical solution for water resources monitoring and management. As a result of using this solution the loss trend in water tables is proved to be effectively controllable.

5. REFERENCES

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