An Intelligent Power Load Control/ Switching System Using an Energy Meter and Relay Circuit

Edward Osita Ofoegbu, Adeleke University, Ile-Ife, Nigeria
Emmanuel Udoh, Sullivan University, Louisville, KY, USA

ABSTRACT
Energy conservation and its efficient utilization especially in cloud data centers has been a subject of discourse amongst numerous stakeholders. Advancement in information technology tools provides a solution to automating the process of electricity metering as well as remote load control alternatives. This paper presents an energy meter reader implemented with a microcontroller based logic methodology fused with a building automation system to implement remote load control by home owners using SMS from a GSM phone. A password based relay circuit was incorporated to ensure secure switching by the user. The system when deployed can enable users query and set energy consumption rates remotely so as to reduce the cost on final consumers as well as conserve energy. This is could be a useful system in the green-based design of cloud data centers.

KEYWORDS
Cloud Data Center, Electricity, GSM, Meter, Microcontroller, Relay

INTRODUCTION
In today’s competitive world, the power and energy sector of any country plays a major role in the growth of domestic, industrial, agricultural, telecommunication, and education sectors. Electricity is the crucial requirement for living a comfortable life and it has to be properly used and managed, especially in cloud data centers that have become central to computing. The electrical metering instrument technology has come a long way from what it was more than 100 years ago. From originally bulky meters with heavy magnets and coils, there have been many innovations that have resulted in size and weight reduction and also, improvement in features and specifications of meters. An electric meter or energy meter is a device that measures the amount of electrical energy supplied or consumed by a residence, business or machine. The most common type is a kilowatt hour meter. When used in electricity retailing, the utilities record the values measured by these meters to generate an invoice for the electricity consumed. They may also record other variables including the time when the electricity was used.

Modern electricity meters operate by continuously measuring the instantaneous voltage (volts) and current (amperes) and finding the product of these to give instantaneous electrical power (watts)
which is then integrated against time to give energy used (joules, kilowatt-hours etc.). The meters fall into two basic categories namely the electromechanical meter and the electronic meters. The most common type of electricity meter is the Thomson or electromechanical induction watt-hour meter, invented by Elihu Thomson in 1888. Resolution and accuracy of the meter have seen substantial improvements over the years (Arun et. al., 2013). Presently, microcontrollers are playing a major role in metering instrument technology. The Automatic Meter Reading system is intended to remotely collect the meter readings of a locality using a communication system, without persons physically going and reading the meters visually. The technology of e-metering (Electronic Metering) has gone through rapid technological advancements and there is increased demand for a reliable and efficient Automatic Meter Reading (AMR) system (Arun et. al., 2013; Kulkhani 2012). One of the proposed methods for AMR system is based on Global System Mobile (GSM).

**Global System Mobile (GSM)**

GSM is a second generation cellular system standard. A GSM based wireless communication module is integrated with an electronic energy meter of each entity to have remote access over the usage of electricity. A GSM channel is a very useful means of communication, as sending data as Short Messaging Service (SMS) turns out to be a very handy tool due to its good area coverage capability and cost effectiveness. GSM networks operate in four different frequency ranges. Most GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated. The rarer 400 and 450 MHz frequency bands are assigned in some countries, where these frequencies were previously used for first-generation systems (ETS 300 502 1994).

**Secure Switching Using Password**

User names and passwords are commonly used by people during a log in process that controls access to protected computer operating systems, mobile phones, cable TV decoders, automated teller machines (ATM), etc. A typical computer user has passwords for many purposes; logging into accounts, retrieving e-mail, accessing applications, databases, networks, web sites, and even reading the morning newspaper online. Despite the name, there is no need for passwords to be actual words; indeed passwords which are not actual words may be harder to guess. Some passwords are formed from multiple words and may be called a pass phrase. The term passcode is sometimes used when the secret information is purely numeric, such as the personal identification number (PIN) commonly used for ATM access. Most organizations specify a password policy that sets requirements for the composition and usage of passwords, typically dictating minimum length, required categories (e.g. upper and lower case, numbers, and special characters), prohibited elements (e.g. own name, date of birth, address, telephone number etc.).

Traditional meter reading for electricity consumption and billing process is done by human operators from house to house and building to building. This requires a lot of human labor and longer working hours in order to achieve complete area coverage of data reading and billing services. Human operator billing services could be hindered by bad weather conditions and also in some buildings, the electric power meter is placed in a location that is not easily accessible (the consumer room). Labor billing job is sometimes also restricted and slow by bad weather condition. The increase in development of residential housing and commercial buildings in developing countries such as Nigeria, require more human operators and longer working hours to complete the meter reading task and to ensure the safety of the electric meter. Automatic meter reader (AMR) system is an effective means of data collection that allows substantial savings through the reduction of loads, greater data
Algorithms for Maintaining Consistency of Cached Data for Mobile Clients in Distributed File System

Multimedia Feature Mapping and Correlation Learning for Cross-Modal Retrieval
[www.igi-global.com/article/multimedia-feature-mapping-and-correlation-learning-for-cross-modal-retrieval/205502?camid=4v1a](www.igi-global.com/article/multimedia-feature-mapping-and-correlation-learning-for-cross-modal-retrieval/205502?camid=4v1a)