IoT Based Smart Energy Metering System

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Abstract - Utilities installed energy meters have advanced tariffs based on load data and in building automation systems the state of appliances can be used for fault diagnostics and calculation of energy consumption. They report only the aggregate electrical energy consumption of a home over intervals if a month. Consequently, they cannot tell the consumers which devices are responsible for their energy consumption. In contrast, disaggregated energy data broken down by individual appliances offers a much plentiful dataset that has the potential to authorize a wide variety of energy stakeholders from homeowner's operators to utilities. In other words, disaggregated energy data enables the utilities and the policymakers to understand how energy is consumed in the home.

Keywords – IoT, Automation, Fault Diagnostics, Energy Consumption, Utility

I. INTRODUCTION

Considering that the electricity meters that are still commonly in use today have been in service for over thirty years, it is worthwhile noting that when a technology like this is replaced, it is utterly insufficient to focus solely on the reason for replacement for present meters. The engineering challenge is to develop a product that can serve as an "in line" replacement for the meters currently in use, while already implementing some (if not all) of the new technology proposed above. This entails that the meter under development must work under the old circumstances and perform all the previous functions (be backwards compatible) but also be able to relay the information in a new way and perform additional functions, without the need of replacing all the meters on the electrical grid simultaneously or the need for extensive new infrastructure. In this project, it is proposed to implement a non-intrusive appliance load monitoring system (NIALM). It can determine the operating schedule of whole electrical loads in a target system from measurements made at a centralized location. In addition, it can identify the operation of electromechanical devices from other kinds of power distribution net and distinguish loads even when many are operating at one time. This system captures the signals from the aggregate consumption, extracts the features from these signals and classifies the extracted features in order to identify the switched-on appliances (see figure 1). We will employ for feature extraction the estimation signal parameter via a rotational invariant technique method (ESPRIT), a well- known parametric estimation technique. ESPRIT is based on theorems that make the extension to higher spatial dimension and to signal containing multiple frequencies possible. NIALM can monitor the operation of the electrical distribution system itself, identifying situations where two or more otherwise healthy loads interfere with each other's operation through voltage waveform distortion or power quality problems. We will also study a classification method. The classification module has the task of identifying an appliance by comparing it with labeled signatures in a database. The main software that we will use is MATLAB which is a high-level language and interactive environment that enables user to perform computationally intensive tasks faster than with traditional programming languages such as C, Embedded C, C++, and FORTRAN. The result of the feature extraction phase is a compact representation of the signal in terms of complex numbers referred to as poles and residues. We will use these complex numbers to determine a feature vector consisting of the contribution of the fundamental, the third and the fifth harmonic currents to the maximum of the total load current. Once a signature is extracted, we will store it in a database of signatures which is used by a classification method to identify the appliance. Results obtained will be evaluated in terms of the success rate

II. SMART METERING SYSTEM

In the Internet of Things (IoT) model, many of the living and non-living things that encompass us will be on the internet in one form or another. Driven by the popularity of gadgets empowered by wire-less technological innovation such as Wireless Bluetooth, Radio Frequency Identification, Wireless-Fidelity, embedded sensor, IoT has moved out from its beginning stage and it is on the edge of changing the present fixed inter-net into a well featured upcoming Internet. Currently there are almost nine billion inter-connected gadgets and it is estimated to touch almost fifty billion gadgets by 2020. Today the world is facing such an environment that offers challenges. Energy crisis is the main problem faced by our society. A relevant system to control and monitor the power usage is one of the solutions for this problem. One approach through which today's energy crisis can be addressed is through the reduction of power usage in households.

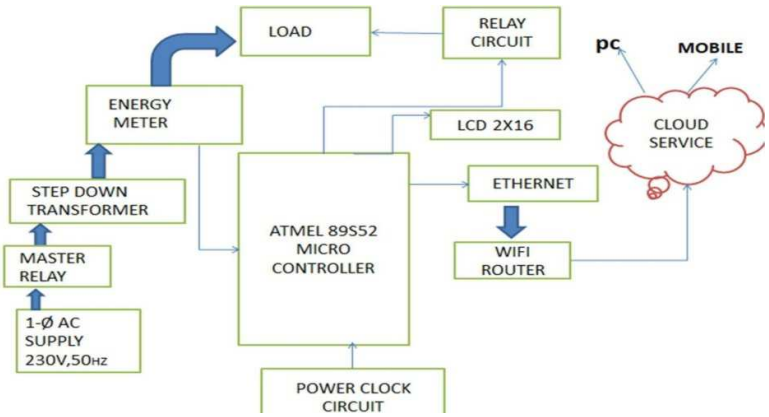

Fig. 1. Proposed IoT based Smart Energy Meter

III. PROPOSED SYSTEM

In the proposed system, consumer can do power management by knowing energy usage time to time. After acquiring of data, that data can be updated on cloud service, so that consumer and provider can access that data through internet. Design and implementation of project is mainly based on 8051 controllers using IOT concept. WIFI performs the IOT operation where and through which the information is sent to the Web server. Iot based smart meter energy calculation. 20 blinks = 0.00625Kwh =1 unit

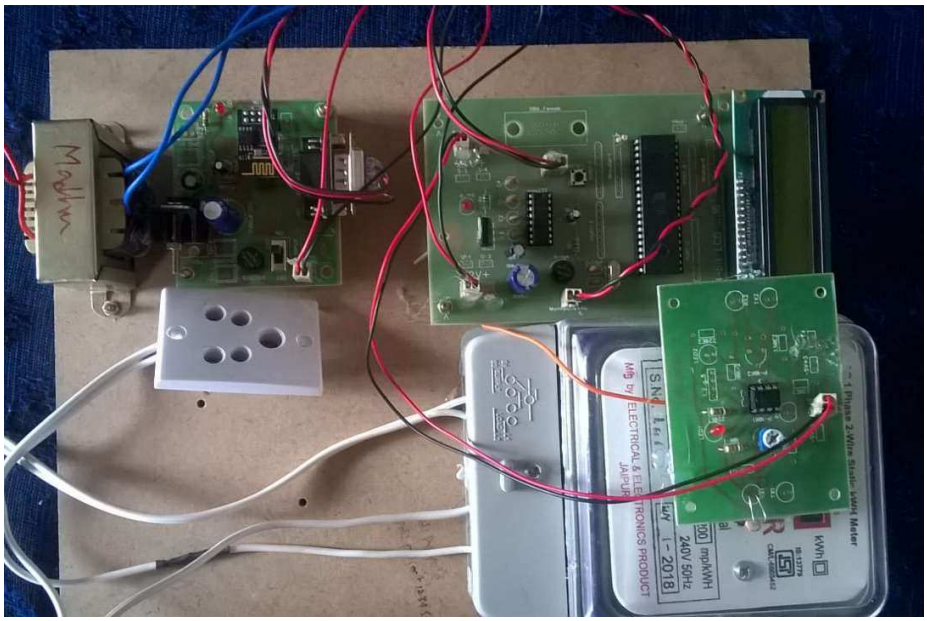

Fig. 2. Smart energy meter

IV. RESULTS

In this section, the validation is carried out on six representative loads. The loads are Incandescent Lamp, economy Lamp, fluorescent Lamp, Iron box, Water Heater, Ceiling fan. The number of Loads and energy consumption rate are mentioned briefly.

V. CONCLUSION

The progress in technology about electrical distribution network is a non-stop process. In the present work by meter reading system is designed to continuously monitor the meter reading and to shut down the power supply remotely whenever the consumer fails to pay the bill. It avoids the human intervention, provides efficient meter reading, avoids the billing error and reduces the maintenance cost. It displays the corresponding information on LCD for user notification. The

advantages of Smart energy meter are it requires less manpower, there is no need to chase payments, power theft detection is possible, bill is sent to the consumer with due date, the meter can act as prepaid meter, can minimize the power consumption in a house.

VI. FUTURE SCOPE

In the present system, IoT energy meter consumption is accessed using Wi-Fi and it will help consumers to avoid unwanted use of electricity. The performance of the system can be enhanced by connecting all household electrical appliances to IoT. So, in future following objectives can be achieved to save power and avoid thefts. This system makes an IoT where the user can monitor energy consumption and pay the bill Online. In future this system makes an user can see when he/she crosses threshold of electricity usage slab. If this system can be developed in future, which shows to the concerned meter reading of that area when theft detected at consumer end.

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