Machine Learning for Smart Energy Monitoring of Home Appliances Using IoT

Komal Ramchandra Tippe¹*, Pooja Ashok Surve², Rashmi Sanjay Kodulkar³, Kajal Kashinath Salgar⁴, Supriya Kumar More⁵

¹,²,³,⁴Student, Department of Computer Science and Engineering, SSDGCT’s Sanjay Ghodawat Institute, Kolhapur, India
⁵Assistant Professor, Department of Computer Science and Engineering, SSDGCT’s Sanjay Ghodawat Institute, Kolhapur, India

*Corresponding author: komaltippe15@gmail.com

Abstract: In today’s world some of resources developed that initiates everyone towards energy efficient technologies. For all resources, among them power is the one which needs to be monitored and controlled as per the user demand since electricity consumption is increasing day-by-day. In this world where almost everything depends on electricity, 67% of energy sources which are used to produce electricity are non-renewable sources of energy. Power is the nothing but the soul of world which is related to the electricity and “electricity” is the term which now rules the world. So, proper usage of energy resources is of very important to us. Even if many technological innovations are taking place in this world but previous electricity consumption billing process seems in India to be very old mannered and does not meet the latest technology are available. The previous system development includes digital meter based on a very cheap distributed components be like microcontroller architecture and current sensors. The previous system includes power lines which already exist and connect every household appliances particular area as it does not require any new installation for establishment of communication medium.

Keywords: IoT, Electric meter, Current sensor, Microcontroller.

1. Introduction

IoT is simply the network of interconnected devices which are integrated with sensors, software, network connectivity and essential electronics that enables them to collect and interchange data making them responsive. An IoT system consists of sensors and devices which “communicate” to the cloud through some kind of connectivity. Once the data obtain to the cloud, software processes it and then might decide to perform an action, such as sending an alert or automatically adjusting the sensors and devices without the need for the user. IoT is essentially a platform where integrated devices are attached to the internet, so they can collect and exchange data with each other. It enables devices to communicate, collaborate and, learn from each other’s experiences just like humans do.

Energy Monitoring has become important for both utilities and facilities with the ever growing demand for energy supply. It is need to make energy management system more efficient with the help of technological advances such as IoT. IoT based energy system for monitoring and controlling would help manages energy usage, enhance efficiency support to conserve energy. The evolution of the internet of things has revolutionized energy management system for proper energy utilization IoT is considered to play vital role in turning this energy management system smarter in the near future. Each device can be connected to the network and the variety of information can be collected from these connected devices. The information from all connected devices is gathered on a central system for the further analysis.

Machine learning is related to IoT can play Associate in Nursing more and more important role in our lives because the days blow over, as each are fields of computing that are presently in a very speedy state of development. IoT desires machine learning owing to some reasons. The primary must do with the quantity of the knowledge and therefore the automation opportunities. The second is expounded to prophetic analysis. Machine learning may be a system that may learn from examples through self-growth and where as not being coded by user expressly. Machine learning collects knowledge with some applied mathematics tools to predict the results. The results then utilized by company make unjust insights. Machine learning is closely associated to data processing. The machine receives knowledge as input, use Associate in Nursing specific algorithmic program to formulate answers. Machine learning is additionally used for a unique task.

2. Literature Survey

In previous system either associate electronic energy meter or associate electro-mechanical meter is found within the space for conniving the energy consumption. The meters presently in use square measure exclusively ready to holding kilogram Watt Hours units. The KWH units used then still ought to be recorded by meter readers monthly.

The meter reading company needs to perform operation on recorded info. For the operation of the meter reading, company
needs to 1st of connect each recorded power usage info to associate account user then analyze the number in hand by means that of the dear tax in use multiple systems style on utterly completely different are designed by different analysis team everxplace the world for Automatic Meter Reading. Tele watt meters were place in send info on monthly basis to a far off office by specific telephone line and some of modems [3].

The [2] current approaches of energy monitoring systems absence the capability for the real-time basic analysis of power excellence data. Power quality analyzers like Fluke Power excellence Analyzers provide built-in processing to measure the various power quality information and are proposed for temporarily metering. An appropriate implementation of energy monitoring system with presently processing power will help to identifying decreasing variations in electrical systems allowing the focus on inspection and proactive maintenance to specific equipment.

An appropriate development of energy monitoring system with real-time processing power will help in recognizing decreasing trends in electrical management systems allowing the special focus on examination and proactive maintenance to some equipment. However, the approximated energy consumption are incorrect and accessible at large time intervals. Therefore, use of an energy monitoring system to assess energy performance with better accuracy in real-time.

Following features are used in an IoT based Energy Monitoring System with real-time data:

- Analyzing Power Quality
- Process design integrating energy data to decrease energy utilization
- Energy consumption adjusted according to energy price information
- Proper use of renewable energy by adjusting production schedules
- Estimation power generation processes

The author [1] elaborated presently electronics energy measurement is continuously replacing previous technology of electro- meters especially in China and India. By the year 2004, digital meter has begin replacing electromechanical device in Singapore. A wireless digital energy meter would positively provide higher convenience to the meter reading task. Bluetooth technology is selected as a possible wireless result to the present issue. In this paper, they present the design and implementation problem with a Bluetooth-enabled energy meter. The energy reader will collect the energy consumption reading from the energy meter wirelessly based on Bluetooth.

The following advantages are considered:

- Computation of operational costs
- Energy efficiency of processes increased based on real-time energy information
- Active maintenance based on power quality data reducing maintenance cost

3. Techniques

There are various methodology of the system is describes within the below Fig 1. The hardware and also the software interface are joined to each other to determine the power usage of the user, this will be observed by server and will be send to cloud from where the clients can log on to the webpage in pc and App put in within the mobile. The smart meter will display the voltage, current and power on display.

![Fig. 1. Architectural design of meter](image)

Development of the present system includes code and hardware implementation. For the implementation of the web site, they used varied forms of programming languages and for the hardware implementation they use differing types of hardware. Current Sensing but poses way more problematic because of the wealthy content within the current wave form. Current electrical device wants a way wider measuring moreover the maximum amount wider frequency vary.

Voltage Sensing is typically gained by victimisation voltage division technique or step down voltage electrical device. Decision, regarding that technique ought to be selected, is said to the work would like. ARM7 MICROCONTROLLER LPC2148 is employed IC from ARM-7 cluster and it’s preloaded with several constitutional devices creating it a lot of helpful and a reliable choice for the new users moreover as high finish application developer. Wi-Fi compatible devices will hook up with the net via a wireless local area network, an online portal is most frequently a specially developed web site that synchronizes knowledge along from distinct resources in a very homogeneous kind [3].

The established system consists of two electronic devices: data acquisition device and data display device, shown in figure 1. The data acquisition device calculates power and energy used by loads and the data display device show calculated data on a small LCD screen and transfer results to the personal computer.

The main characteristics of this monitoring system are: wireless communication between acquisition and display devices, monitoring ability of the device and switchboard circuit’s level, average hourly power usage and electricity cost information display, and data holding on the personal computer. Wireless communication between devices assures better flexibility and system’s ease of use. The system’s capability to examine both device level and switchboard circuit’s level notify
the user about the equivalence of each device or circuit load. The knowledge of use of electricity gives eventful data that inspiration changes to the user behaviour.

A computer conjunction is accessible to record calculated information and to use it in many computer applications, such as, daily charting energy use data [4].

4. Conclusion

As previous system needs manual checking of energy meter reading and it’s difficult to determine because it shows the monthly energy consumption of the power. To overcome this problem there is solution to associate IoT low-priced energy monitoring system that utilize non intensive current detector. This system will provide elaborate activity of energy usage and also the patterns of energy consumption. Hence, users will understand their electricity usage patterns and then will adapt their behaviour to scale back their energy profile.

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Caveats</th>
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<tbody>
<tr>
<td>K-means</td>
<td>Fast, well documented.</td>
<td>Risk of Local optimum. Difficult to find optimum cluster</td>
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<tr>
<td></td>
<td></td>
<td>Number and interpret clusters.</td>
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<tr>
<td>Hierarchical</td>
<td>Visual interpretation, fast.</td>
<td>Careful selection of link function is required</td>
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<td>Follow-the-leader</td>
<td>No initial number of clusters to fit.</td>
<td>Needed Distance threshold is chosen by trial-and-error</td>
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<td>Mixture Models</td>
<td>Advanced modelling of systems.</td>
<td>Complex setup compared to K-means</td>
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<tr>
<td>Neural Network</td>
<td>Supervised, taking into account Prior knowledge</td>
<td>Risk of over fitting, needs prior knowledge</td>
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References