

Peak load scheduling in smart grid using cloud computing

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ABSTRACT

In this paper present peak, energy management attainable is feasible by monitoring real-time readings of whole loads within the college premises victimization this schedule loads so energy saving is possible. Currently, cloud computing technology offer on-line real-time monitoring knowledge, we have a tendency to create project supported cloud computing application for energy management that is employed for monitoring real time consumption of electricity and load planning. With respect to monitoring knowledge, we have a tendency to be able to plot the load curves so it'll be useful in achieving optimum energy consumption for educational institute.

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1. INTRODUCTION

Nowadays whole world is facing a haul like energy crisis to avoid this correct energy management is critical for a business, organization, industry, and individuals. Energy management negligence has a affect on individuals there measure totally different error turn out therefore this cause serious fault comparable to shorts, this have the flexibility to supply fires alongside burn the realm. These days there's a awfully huge downside because of shorts, impact of this starts hearths and burns down the business building there measure several samples of contact caused fire recently in Mumbai. The report was given by NCRB; recently Mumbai ranks second briefly circuit fires, with 418 deaths in ten years. Energy management negligence will have an effect on an individual in many aspects as mentioned on top. Safety may be a huge concern for every person for this purpose. We have a tendency to need an accurate tool for actual observance of electricity consumption in order that the most incident can be avoided. Good domestic power management uses subtle and stylish technologies in order that the ability management systems effectively use and manage power consumption. For peak load scheduling purpose correct tools need to observe daily power consumption in order that most incidents can be avoided. Recently launched new technologies just like the internet of things provides money edges and various tasks steer clear of human intervention because of this thing quicker alongside potency. Internets of things solely the logical plan that accustomed produce system fulfill the wants of the society.

During this paper, we have a tendency to after all impose peak load scheduling theme for the business load victimization cloud computing. The target of peak load scheduling theme decreases the most hourly load demand for equalization everyday load schedule. We have a tendency to use cloud computing technology which supplies real-time energy consumption. In this paper authors has planned system design which is helpful to solve increasing unnecessary power consumption in an individual domestic via the concept of the internet of things. This design is helpful for monitor and analysis power consumed by the outlets in the domestic via sensors and microcontroller [1]. They inspect power scheduling scheme in the

same way energy shift table appliances and time shift able appliances using by position to individual energy consumption patterns. Using the help of enhanced programming and algorithm complete scheduling plan this is useful for limit the operational time also the energy of each individual domestic devices this technique also applicable for commercial system [2]. Introduces cloud computing technology useful for a handling large amount of data and processing. In this proposed system open stack cloud is set up for different applications also performance tested under changing workload condition [3]. Project based on cloud computing application power planning also provide information, management of the grid. They make the project based on cloud computing application which implements an alarm system and alters system when the current value exceeded by its demand value [4]. In this paper suggestion for incorporation of grid based cloud model has been discussed. Cloud computing technology which is used for to decrease hardware cost also the applications managed by the third party called as cloud provider [5]. To improve the regular power grid to a smart grid, which is coming age of electrical power frameworks, the thought of decentralized and DSM system is essential [6]. Emerging new technologies like distributed generation, distributed storage, and demand-side load management will change the way we consume and produce energy [7]. A study of energy electricity generation allocated evenly to every three houses having no competition among them is carried out [8]. A review of management of several of intelligent devices such as smart meters and power assets efficiently; and to process a large amount of data received from these devices [9]. A novel model to deal with the large data and power use by incorporating direct burden control program with smart metering framework has been developed [10]. Initially the software developed at the National Renewable Energy Laboratory (NERL), later advanced and distributed by HOMER Energy [11]. Coordinating autonomic metering for distributed computing dependent on autonomic figuring ideas has been examined [12]. Internet of Things (IoT) empowered gadget that can speak with various advanced meters through different modes of communication convention [13]. An installation of controlling unit (CU) located at each distribution node for remotely monitoring the energy of the domestic and agricultural customers is discussed [14]. It proposes HEMS that thinks about both generation and energy consumption all the loads using Zig-bee based communication mode and GSM mode [15]. Various modes of energy management techniques have been discussed which are using internet based communication technologies. Pros and cons are being elaborated [16]. Heterogeneous communication network employing renewable hybrid sources to the grid are explored for effective management of energy [17].

2. RESEARCH METHOD

2.1. Installation of smart energy meter

The observation of data stored in the cloud and analyzing it for calculating the various parameters will need advanced metering infrastructure to be installed. At the location of distribution transformer install 3phase smart energy meter. It consists of intelligent device, microchip, data contractor unit and sensors that operate for real-time observation and can store the collected information on cloud, this real-time information store on the cloud will be accessed on PC/ laptop/mobile via net browsing on cloud computing. The software-based programming is ready that send alarm on mobile, the alert is provided by a system. This inspection information we have a tendency to area unit ready to plot the load curves therefore this can be useful in achieving optimum energy consumption. This project shows abstract diagram shown in Figure 1 utilize cloud computing application for actual time watching of information of knowledge of information by putting in extra energy meter in college premises, the particular data is hold on cloud completely different parameter like voltage, current, power issue, power consumption watching is vital. Perceptive this parameter prediction will be done close to future. Essentially this cloud application is employed for power management.

Figure 1 shows an abstract set for this project that uses application of cloud computing energy management. The utilization of cloud computing for real-time observation of substation would like to observe specific load measurement and analysis of consumption patterns remotely. By fitting any smart energy meter in college premises the real-time data can be hold on inside the cloud. Victimization varied properties of cloud computing this project work reliable and smart approach for real-time data. By perceptive varied readings like voltage, current, Power issue, frequency and total consumption use for prediction can be finished in future.

Hardware setup of smart meter shown Figure 2 is installed near at distribution transformer. Following different component present in smart meter CT this electrical device is used for measuring of flow current within the smart meter. Actual time data assortment and on-line observation of voltage, current, power consumption, power issue is possible. This offers actual time notification alerts regarding modeling victimization world system for mobile (GSM) via SMS. Buffering happens once there is a failure of communication & power disruption. Figure 3 shows diagram of information concentrator unit that consists of 5v adapter, transformer, universal asynchronous receiver & transmitter (UART), debug port, programming

port, switch logic, reset switch, real-time clock (RTC), watchdog timer & internal antenna. This device sends the data to cloud-enabled power observation system placed on cloud server show in Figure 4.

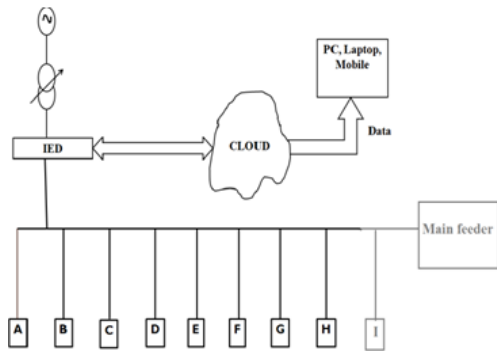


Figure 1. Conceptual block diagram



Figure 2. Top view of smart meter

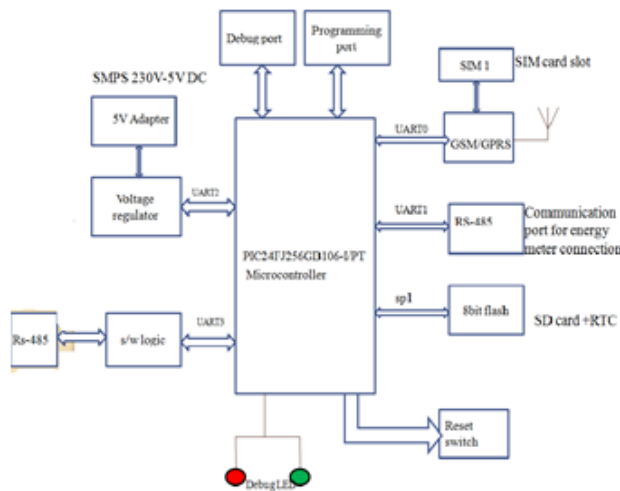


Figure 3. Block diagram of data concentrator unit



Figure 4. Internal diagram of DCU

2.2. Simulation

The HOMER Pro® micro grid software by HOMER Energy is the global standard for optimizing micro grid design in all sectors, from village power and island utilities to grid-connected campuses and military bases. Originally developed at the National Renewable Energy Laboratory, and enhanced and distributed by HOMER Energy. Cloud computing is an effective technology in identifying and perusing a complete energy management program. Cloud computing will give the organization a real-time data with which it can effectively manage the organization energy system at a minimum energy cost show in Figure 5.



Figure 5. Simulation graph

3. RESULTS AND ANALYSIS

Subsequent Figure 6 shows actual on-line information monitoring of 27th June that is employed for drawing the daily load curve, this is convenient for analyzing peak load within the day. This is showing the voltage, current, power consumption, power issue conjointly this method provides data regarding the alerts once MCB trip. For the peak load planning purpose actual time information daily power consumption is critical exploitation this information observe the peak hours so therein peak hours shift in a position load shift in off-peak hours exploitation this conjointly get the balance between supply & demand.

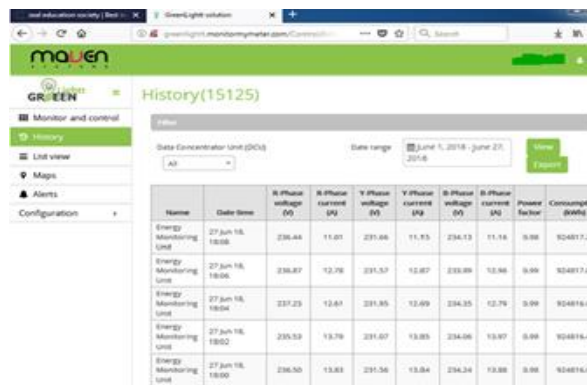


Figure 6. Snapshot of online data monitoring 27th June

Following Figure 7 shows the recorded daily units consumed in educational institute exploitation this curve to research that peak hour required to shift from peak hours to off-peak hours. This particular time observation information is useful for drawing daily load curve so this offers once there's peak demand. Pumping load in educational institute campus. Table 1 shows that pumping load total wattage of the pumping load is 7460 watts.

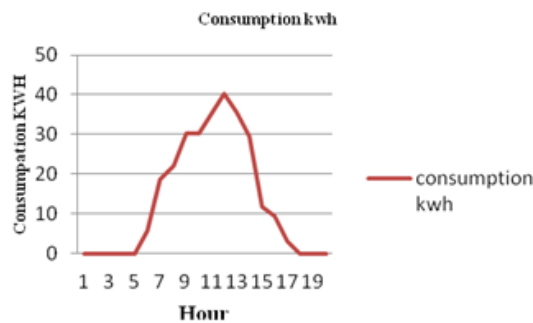


Figure 7. Recorded daily units of consumer

Table 1. Pumping load

No of motors	Rating in HP	Watts
2	1.5	2238
2	2	2984
1	3	2238
Total	10	7460

Table 2 shows that time of day usage involves dividing the day into tariff slots for industrial load additionally to base tariffs. Exploitation this information client simply get a concept regarding shifting of peak load to off-peak load periods. In peak load periods higher rate of electricity & off-peak load periods low rate of electricity. once water pumping system is on in peak hours 9am to 12pm need to paying further charges 0.8 Rs/Unit so total charge pay 8.06 Rs/Unit. After rescheduling of the water pumps in morning timings from 6 am to 9 am charge to pay 7.26 Rs/unit.

$$\text{Energy price of water pumping} = \text{no. of motor} \times \text{Wattage} \times \text{hour} \times \text{Rs/unit} \tag{1}$$

During this section, we'll discuss results. The subsequent Figuree 6 shows period of time reading total power consumption educational institute premises. For this space one year subscription value paid to server. The subsequent facts have emerged when the rescheduling of water pumps in morning timings. Total value reduction annually is 10,166 rupees. It highlights the quantity of energy savings that may be obtained in an educational institute, thereby energy crisis is reduced significantly. The subsequent facts have emerged once the careful energy management studies of field.

Table 2. Time of day

TOD Tariffs(in addition to base tariffs)	Energy charge(Rs/unit)
2200Hrs-0600Hrs	-1.5
0600Hrs-0900Hrs & 1200Hrs-1800Hrs	0
0900Hrs-1200Hrs	0.8
1800Hrs-2200Hrs	1.1

Figure 8 shows that graph shifted from on-peak hours to off-peak hours. This graph is obtained once water pumping load is shifted from on peak hours 9 am to 12 pm this can be peak hours in order that we've got to pay additional charges 0.8 Rs/Unit thus to avoid this pay additional charges there would like be for peak load scheduling in order that shift in a position loads shift off-peak hours. During this rescheduling of water pumping system into morning 6 am to 9 am applying peak load scheduling not solely scale back additional charges however additionally a gap between supply & demands scale back.

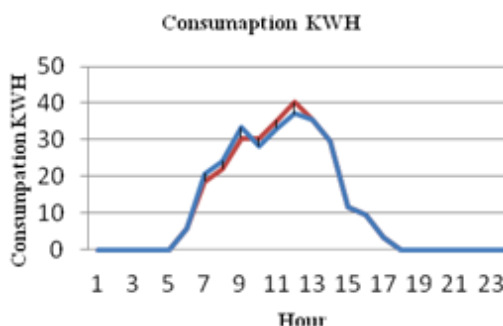


Figure 8. Result of peak load scheduling

4. CONCLUSION

Cloud computing is an efficient technology in distributing and browsing an entire energy management program. Cloud computing can provide the organization a real-time information with that it will effectively manage the organization energy system at a minimum energy price. During this project work, a close study has been done to suggest for the reduction of the electrical energy value within the complete

educational field. Smart energy meter data analyze and monitor actual time energy consumption victimization this correct energy management is done in order that shorts circuit downside ought to be avoided additionally there's money profit. Peak load scheduling of smart grid victimization cloud computing aims to regulate and observe the ability consumption analyze the shift in a position load in peak hours in order that the energy crises downside minimize. Rescheduling of water pumping system total value reduction per annum is 10,166 rupee and payback period is two years.

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