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Modern Power Demand Control for Smart Homes

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ABSTRACT: To evade the problems at some point in power cut period, power demand control is to solve power demand problems in smart homes. This system controls the current level of electrical loads to sustain the total electrical power demand during a demand interval. An electrical power demand is metered frequently on the origin of a predetermined demand interval. At some stage in this demand interval the utilization of electrical energy is accumulated and averaged. Thus, in this systems have been formulated for sustaining the demand below a predetermined peak value during the demand interval thereby restraining this peak demand charge. Choose the electrical appliances, estimate the wattage rating during peak hours and evaluate the wattage rating based upon regular hours and peak hours. When the energy consumed is superior to the encoded value and the system is physically tripped to diminish the energy consumption and attentiveness is send by the message through GSM if 90% of energy is consumed.

KEYWORDS: Load management, load priority techniques, peak demand, maximum consuming puissance, home appliance priority

I.INTRODUCTION

On an ecumenical substratum, electrical energy today constitutes about 30% of the total annual energy consumption. In the last decade, both electric utility and customers have experienced incrementing costs for electric power due to escalating costs of burning fuels and capital costs for building incipient generation capacity. As the standards of living and electricity consumption perpetuate to increment and transmutes in the electricity use patterns due to technological changes and other reasons, it becomes obligatory for the utilities to take care of the generation capacity and peak demand requisites. Policies were developed by many countries to cope up with the situation by amended energy consumption. Demand control is a system for controlling the operation of electrical loads. The purport of the authoritative ordinance controller is to maintain the total electrical power ordinant dictation of the load at or below a predetermined peak demand. The concept of this system is utilized for controlling a single electrical load but is preferably employed in controlling a plurality of electrical loads.

The puissance demand is metered by predetermined interval, which may be, for example, a 15 minute, 30 minute or 60 minute time interval. Thus, in this systems have been devised for maintaining the authoritative ordinance below a predetermined peak value during the authoritative ordinance interval thereby circumscribing this peak demand charge. Some of these techniques, however, such as a zero-order constant rate comparison technique have not been thoroughly copacetic. Accordingly, one object of the present invention is to provide an injuctive authorization controller having an amended forecasting technique. Another object of the present invention is to provide an injuctive authorization control technique that can be implemented relatively simply without the desideratum for extortionate intricate data processing and logic circuitry.

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1. Overview of Demand Control

Power demand control is to solve power demand quandaries in keenly intellective homes, in order to evade the quandaries during power cut period. This system controls the electrical loads to maintain the total electrical power demand during an authoritative ordinance interval within certain predetermined limits with prioritization of particular loads. Power demand control is utilized for controlling the operation of electrical loads. The purport of the injuctive authorization controller is to maintain the total electrical power of the load at the time of puissance cut. The puissance demand control is utilized for controlling six electrical loads but is sooner employed in controlling a plurality of electrical loads on a priority substructure.

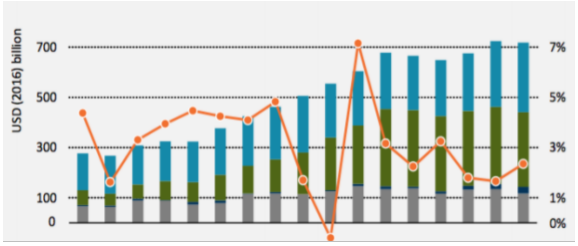

Fig. 1 Peak Demand Graph

Peak demand graph of the proposed system is shown in Fig. 1. However, several appliances can be operated at the time of puissance cut, at the same time apart from the prioritized loads, if other loads are in utilize it will be automatically switched off with the avail of Microcontroller (PIC16F877A) unit. The advantages of cellular communications like GSM (SIM 300) technology are a potential solution for such remote controlling activities.

2. Generation

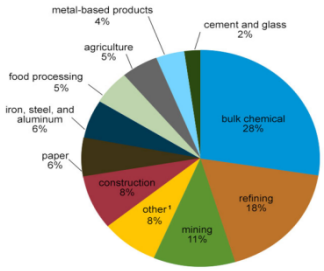

Fig. 2 Generation Status

Generation Status of TNEB of the proposed system is shown in Fig.2. It has recorded the amalgamated thermal generation during the years 2006-07 and 2007-08 was 21,288 Million Units and 21,355 Million units respectively. Substructure stone was laid for the first super critical thermal power project of capacity 1600 MW under Joint Venture between TNEB and BHEL on 22.02.09. Charity stone was laid for the thermal power project of capacity 1000 MW in Joint Venture between TNEB and NLC on 28.02.09. The Engineering Procurement and Construction (EPC) for perpetual North Chennai TPS Stage-2 of capacity 1200 MW was awarded to M/s BHEL. In principle, REC approved Rupee Term Loan of Rs.2475 Crore for Unit-1. The EPC for perpetual Mettur TPS Stage-3 of capacity 600 MW was awarded to M/s BGR Energy/Chennai. In order to bridge the injuctive authorization-availability gap, TNEB is exploring the possibility of establishing of 2X600 MW coal predicated Thermal Power Project. The Industries Department, GoTN is slaking to allot about 500 acres of in the TIDCO's Multi Product Special Economic Zone in Thriuvallur District.

A supplemental Gas predicated thermal project with a capacity of 92 MW had been commissioned on 17.02.09 at Valuthur in Ramanathapuram. Administrative approbation has been accorded by the Board for the establishment of Co-generation Plants to engender power utilizing coal of sundry capacities 7/12/15/18 MW at an estimated cost of Rs.1176.70 Crores, with a totaling of 234 MW in 15. The GoTN is emboldening the private promoters for developing Merchant Power Plant (MPP) and issued facilitation letter to 10 MPP totaling to a capacity of

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17,140MW utilizing imported coal as fuel. Tamil Nadu is one of the states culled by Regime of India for the founding of Ultra mega power project (4000 MW) at Cheyyur. 21 Minute HEPs of total capacity 118.65 MW are to be allotted to the Private Promoters through Expression of interest route after finalization of terms & conditions on Minuscule hydro development by Private promoters. So far, under Renewable Energy Sources, 8018 WEGS of 4118 MW, 22 Co-generation plants of 466 MW and 16 Biomass plants of 137 MW has been integrated to the grid.

II.EXISTING SYSTEM

The highlight of the subsisting system is its facility to control maximum consuming power of the abode appliances (HAs) and keep the total power consumption below a certain limit and sanctioning the domicile utilize more flexibility to operate their HAs predicated on HA priority. The perspicacious power management system consists of perspicacious electric sensors (SESs) and power provisioning controller (PPC). The PPC and SES are concurrently used to control and maintain stability and consummate power waveform deportment examination. However, we require to reassign an amount of consuming power from one HA to another when the ON/OFF status of HA changes. This system offers a system to control the maximum power consumption considering heterogeneous HAs with different replication celerity. In order to assure the maximum consuming power limit, it computes the circumscribed suggested power level for HAs.

III.PROPOSED SYSTEM

Demand Replication (DR) commonly refers to programs that target to incentivize energy consumers to transmute their electric utilization habits in replication to transmutations in electricity prices or incentive payments, in order to achieve low electricity utilization in peak demand periods DR program prevarications not only on these keenly intellective technologies, but mainly on implementing an efficacious design of the predicated mechanism that will amend the efficiency, reliability, and safety of the grid as well as it will be salutary for the consumers.

The block diagram of the proposed system is shown in Fig. 3. It comprises of supply unit, current and voltage transformer, relay and load are connected with the microcontroller. Power demand controller is a current controlling contrivance. This is to be installed in each and every house. In a day for mundane 22 hours maximum power consumed by consumer but for the particular 2 hours the prioritized 6 loads will be operated, once if the 6th load is on the Microcontroller unit automatically switches off all the adscititious loads. Thus the excess load cannot be utilized by consumer. For mundane 22 hours power from energy meter is directed provided load. For that particular two hours the current flow path is transmuted by utilizing relay.

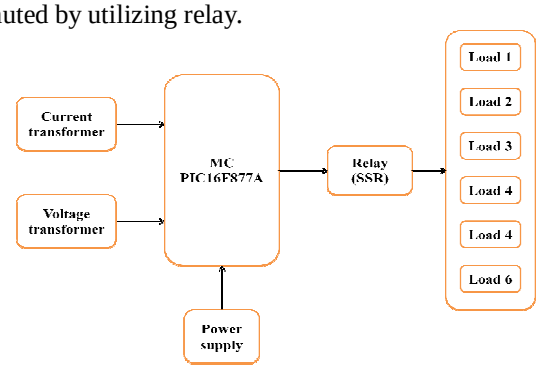

Fig. 3 Block Diagram

Thus the current flow direction is changes by utilizing timer buffer and comparator in feature current cut may be three hours or four hours which timing is desired in utilizing timer. The time when the load is prioritized then it is decided by the buffer and comparator. When signal from EB comes the comparator compares the signal and it holds the

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signal for some times after that the timer triggered with be speaker now the prioritization of load is occurred. After timing is culminated, the controller will turn off immediately and mundane power flow will occur.

a) Power Supply Unit

All digital circuits work only with low DC voltage. A puissance supply unit is required to provide the felicitous voltage supply. This unit consists of transformer, rectifier, filter and a regulator. AC voltage typically of 230Vrms is connected to a transformer which steps that AC voltage down to the desired AC voltage level. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to engender a DC voltage. This resulting DC voltage conventionally has some ripple or AC voltage variations. Regulator circuit can utilize this DC input to provide DC voltage that not only has much less ripple voltage but withal remains in the same DC value, even when the DC voltage varies, or the load connected to the output DC voltage Changes. The required DC supply is obtained from the available AC supply after rectification, filtration and regulation.

b) Transformer

Transformer is a contrivance used either for stepping-up or stepping-down the AC supply voltage with a corresponding decreases or increases in the current. Transformer is utilized for stepping-down the voltage so as to get a voltage that can be regulated to get a constant 5V and transformers are employed for widely varying purposes to reduce the voltage of conventional power circuits to operate low voltage contrivances, such as door bells and toy electric trains, and to raise the voltage from electric engenderers. So that electric power can be transmitted over long distances.

c) Rectifier

A rectifier is an electrical contrivance that converts alternating current, which periodically reverses direction to direct current, which flows in only one direction. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury arc valves, stacks of copper and selenium oxide plates, semiconductor diodes, silicon controlled rectifiers and other silicon-predicated semiconductor switches. A rectifier is a contrivance like the semiconductor diode, which is capable of converting sinusoidal input waveform into a unidirectional waveform, with a non-zero average component.

d) Filter

Electronic filters can be passive or active, analog or digital, high-pass, low-pass, band pass, band stop, all pass, discrete time or continuous time, linear or non linear. Electronic filters are circuits which perform signal processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones, or both. The capacitors are used as filters in the power supply unit. The action of the system depends upon the fact, that the capacitors stores energy during the conduction period and delivers this energy to the load during the inverse or non-conducting period. In this way, time during which the current passes through the load is prolonged and ripple is considerably reduced.

e) Voltage Regulator

Three terminal regulator available with several fine-tuned output voltages making them subsidiary in a wide range of applications. LM78xx is a family of self-contained fine-tuned linear voltage regulator integrated circuits. The 78xx family is commonly utilized in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. The voltages available sanction these regulators to be utilized in logic systems, instrumentation, Wi-Fi and other solid state electronic equipment. Albeit designed primarily as fine-tuned voltage regulators, these contrivances can be utilized with external components to obtain adjustable voltages and currents.

f) MAX 232

The MAX232 is a dual driver/receiver that includes a capacitive voltage engenderer to supply RS 232 voltage levels from a single 5v supply. Each receiver converts RS-232 to 5v TTL/CMOS levels. Each driver converts TLL/CMOS input levels into EIA-232 levels. The P3_0 (RX) and P3_1 (TX) pin of controller is connected to the max 232 driver and the TX and RX pin of max 232 is connected to the GSM modem or PC.

g) GSM Modem

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem deports like a dial-up modem. The main distinction between them is that a dial-up modem sends and receives data through a fine-

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tuned telephone line, while a wireless modem sends and receives data through radio waves. The working of GSM modem is predicated on commands, the commands always start with AT (which betokens Attention) and culminate with a <CR> character. For example, the dialing command is ATD<number>; ATD3314629080; here the dialling command ends with semicolon. The AT commands are given to the GSM modem with the avail of PC or controller. The GSM modem is serially interfaced with the controller with the avail of MAX 232. Here max 232 acts as driver which converts TTL levels to the RS 232 levels. For serial interface GSM modem requires the signal predicated on RS 232 levels. The T1_OUT and R1_IN pin of MAX 232 is connected to the TX and RX pin of GSM modem.

h) Relay Driver

A relay driver circuit is a circuit which can drive, or operate, a relay so that it can function opportunely in a circuit. The driven relay can then operate as a switch in the circuit which can open or close, according to the desiderata of the circuit and its operation. A relay driver for both DC and AC relays. Since DC and AC voltages operate differently, to build relay drivers for them requires remotely different setup. Generic relay driver which can operate from either AC or DC voltage and operate both AC and DC relays. All relays come with a voltage rating. This is called on a relay's datasheet its rated coil voltage. This is the voltage needed in order for the relay to be able to operate and be able to open or close its switch in a circuit. In order for a relay to function, it must receive this voltage at its coil terminals. Thus, if a relay has a rated voltage of 9VDC, it must receive 9 volts of DC voltage to operate. So the most consequential thing a DC relay needs is its rated DC voltage.

i) Physical Scheming of the Proposed System

As the residential areas are one of the main power consumers today, reducing power in habitation could contribute significantly to the environment. Hence, a keenly intellective power management system is needed in keenly intellective homes, which is responsible for observing and handling home appliances.

Loads	Electrical Load in Amps/Hr	Wattage Rating	Duty cycle per 24 Hrs	Total watts per 24 Hrs
Load 1	0.36	40	9	360
Load 2	0.36	40	4	160
Load 3	0.54	60	2	120
Load 4	0.54	60	1	60
Load 5	0.90	100	3	300
Load 6	0.90	100	6	600
Total (Watts)				1600

Table 1 Electrical Loads

Here the loads with different rating and Amps are used. The proposed system has calculated the duty cycle/24 hours and total Watts per 24 Hours for each load individually which is shown in Table 1. It is used to check the time duration of the peak load. From this calculation it is observed, that the load 1 and load 6 consumes the peak load of 360W and 600W respectively while comparing the other loads.

Time(Hours)	0-6	6-10	10-12	12-16	16-20	20-24
Load(Watts)	320	365	230	250	300	135

Table 2 Daily Load Cycle

The daily load consumption of the proposed system is shown in Table 2. The load consumption for every 2 hours has been analysed from the table, which is used to find out the time duration of peak load. The peak load occurs at 6.00-10.00AM when all loads are switched on. During 0.00-6.00AM, 6.00-10.00AM, 10.00-12.00AM, 12.00-16.00AM, 16.00-20.00AM and 20.00-24.00AM the load consumes 320W, 365W (peak load), 230W, 250W, 300W and 135W respectively. The maximum load time and minimum load time has been determined from the Table 2. An electrical power demand is metered usually on the basis of a predetermined demand interval. During this demand interval the consumption of electrical energy is accumulated and averaged. When the energy consumed is higher than

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the predetermined value and the system is manually tripped and it will send an alert message to the user through GSM Module.

IV.RESULT & DISCUSSION

The proposed system uses Maximum Demand Limiter (MDL) which reduces the puissance cuts by curtailing the potency supply to the loads during the peak times. After implementation of the MDL at domestic consumer's premises verbally express, it is able to control non vital loads during the peak hours; hence there is fall in demand by 20%.

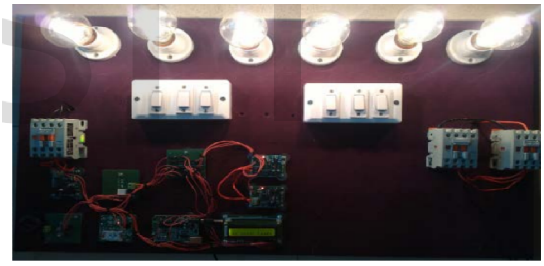

Fig. 4 Loads during Peak Hours

The position of load during peak hours of the proposed system is shown in Fig. 4. During peak hours all the loads are consumed. The energy required during morning time is high, so there is a desideratum to consume all loads depending upon consumer requisite. This results increase in the peril of potency blackout effects, so it is compulsory to control the energy consumption to eschew energy shortage and power cut.

Fig. 5 Loads during Normal Hours

The position of load during mundane hours of the proposed system is shown Fig. 5. During mundane hours the energy consumed by the human is lower than peak hours because, it requires only constrained loads. It utilizes half the load utilized in peak hours. So Energy consumption is reduced. The proposed system have limpidly explicated the result, how to surmount the quandary of peak load with the avail of MDL (Maximum Demand Limiter). This method will surely auxiliary during the authoritative ordinance supply of potency. So, the system can control the electrical load.

V. CONCLUSION

Efficient power consumption, keenly intellective power monitoring and interactive control of puissance consumption in keenly intellective homes are the key factors of sustainable development. Power demand quandaries in astute homes, in order to eschew the quandaries during power cut period. Aim is to determine the areas of peak hours of electricity utilization levels and come with a solution by which it can lower the consumption and enhance better utilization of already constrained resources during peak hours. The calculated wattage rating shows that energy consumed in peak hours is more than the mundane hours, so there is a desideratum to reduce energy utilization and thereby it avails to ameliorate energy savage. GSM sends warning by the message to control the energy utilization and

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exhibit the remaining wattage predicated on predetermined value. The potency control system provide reliability by absents of potency cut. Reduction of puissance demand will result in avoidance of blackout effects.

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