Priority Based Load Management and Gas Monitoring for Competent Household Energy Management

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***Abstract*— Energy management refers to the process of monitoring, controlling and conserving energy in an area. The main goal of this energy management system is to reduce the power consumption by employing certain mechanisms. To achieve this, monitoring the energy consumption and managing the appliances are needed. In order to reduce the energy consumption, firstly it is necessary to know how energy is consumed. Therefore consumption monitoring is required. Secondly it is necessary to manage the appliances in order to apply energy reduction strategies. A context- aware system is capable of collecting information from the management or context, and of reacting accordingly. The proposed system is capable of controlling the electricity by automatically perform smart load control based on utility signal and load priority and automatic gas monitoring. The system can also adjust the light intensity according to the surrounding brightness. The sensor measurements are used for scheduling and controlling of different loads. The user can get information regarding the power consumption and gas leakage via wireless GSM technology.**

Index terms-energy management, load priority, intelligent light control, gas monitoring.

I. INTRODUCTION

As more and more home appliances and consumer electronics are installed residential energy consumption tends to grow rapidly. A large number of home devices increase power consumption in two aspects, standby power and normal operating power. These two kinds of power consumption are proportional to the number of home devices. As a result operational cost in home area is also increasing. Home appliances and consumer electronics accounts for about 27% of home energy consumption [1]. A recent study found that 10% of energy saving was achieved with a monitoring system providing real time energy information. The most waste of energy comes from inefficient use of electrical energy consumed by
artificial light devices. This paper also presents a method for saving electrical energy consumed by automatically controlling the light intensity to a satisfactory level.

Recent studies have highlighted that a significant part of electrical energy consumption in residential and business buildings is due to an improper use of electrical appliances. In this context sensor based intelligent system that monitors the energy consumption and automatically controls the behaviour of appliances is used in a building. Priority based load controlling is one of the effective way to save electrical energy [1].
. With the introduction of the smart grid, it is now possible to perform demand response at customer premises to get a finer control of the available resources. Demand response (DR) is defined as ―changes in electricity use by demand-side resources from their normal consumption patterns in response to changes in the price of electricity, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices. Due to this reason, and the fact that there has not been a mature time-varying tariff for residential customers, the DR concept for our hardware demonstration is based on the incentive based DR program
The research has indicated that over 40% of supplied power for domestic users has been wasted by overheating, overcooling, leaving appliances in standby/off modes, heating/cooling unoccupied rooms .To achieve domestic energy saving and efficiency, energy monitoring technologies that provide real time feedback on energy consumption have been employed and can mitigate the usage by up to 15% [2]. Priority based load management can be more efficiently used in power intensive appliances. Load priority algorithm considers that controllable loads in a house such as water heater, air-conditioner, cloth dryer etc. The gas monitoring indicates the amount of gas usage and leakage detection using sensors.

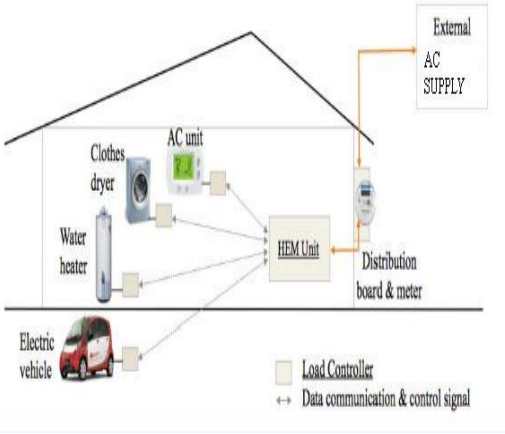

Figure.1 Overview of the Proposed Energy Management System

II. RELATED WORKS

Automatic gas monitoring in a domestic energy management system provides effective positive behaviour change by offering end users direct and ambient feedback based on their monitored energy consumption and experiences [3]. Smart home energy management system for monitoring and scheduling of home appliances using ZigBee consists of two main parts. One is energy management centre consisting of graphical user interface and the second part is load scheduling which is performed using the single knapsack problem. A home energy management system provide direct feedback through a home network shortly after consumption occurs have been considered and realized to achieve energy efficiency.

Compared to other energy management and monitoring system, the proposed system focuses on automatic priority based load management and gas monitoring. The system collects information from different sensors and schedule appliances using load priority algorithm.

III. THE PROPOSED SYSTEM

The proposed system is mainly used in the case of power intensive loads such as water, heater, air-conditioner, refrigerator, cloth dryer etc.[6]. It works as per the load priority algorithm and the amount of power supply. The sensors attached to the loads provide information to the controller whether to switch ON/OFF selected loads based on the utility signal received as well as load priority and preference settings. The controller used is ARM7 which provide necessary control actions for appliances. The light intensity can be varying according to the value of LDR sensor [7]. The relay circuit provides the capability to switch selected appliances ON/OFF depending on the command from the controller. The amount of gas usage and leakage detection can also be performed using gas sensors [8]. The information related to the amount of power consumption and gas leakage information can be transmitted via wireless GSM technology to the user [9]. The block Diagram for the proposed system is shown in Figure 3.

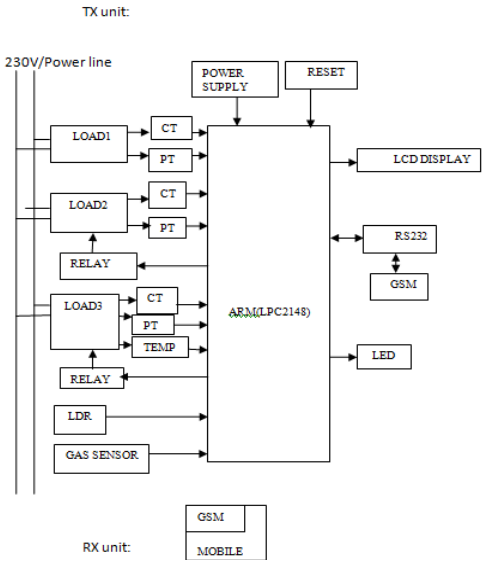

Figure.2.Block Diagram

IV. THE PROCESS DESIGN FLOW

The flow diagram for the energy management system is shown in Figure.3. The system mainly focuses on controlling of household appliances like water heater, air-conditioner, refrigerator etc. by using automatic load priority algorithm. The system will works under four conditions for load value greater than 220v, greater than 180v, greater than 110v, and less than 110v. The system monitors the luminosity inside the room by automatically changing the light intensity according to the brightness of surroundings [8]. It also checks for the amount of gas usage and leakage detection. If there is gas leakage the system provides an alarm and also sends a message to the user. The load management algorithm starts by gathering system information demand limit, appliance power consumption in KW, load priority, customer's settings. In this system consider three loads as load 1, load 2 and load 3.The algorithm first check for the condition whether the load value is greater than 220v.If it is true all the load will work, else it check for the second condition if the load value is greater than 180v, then the highest priority load will OFF and remaining ON. In the third case, load value is greater than 110v, then two highest priority load will OFF and the remaining one ON. If there is not enough power supply to turn ON appliances, all loads will be in OFF condition.

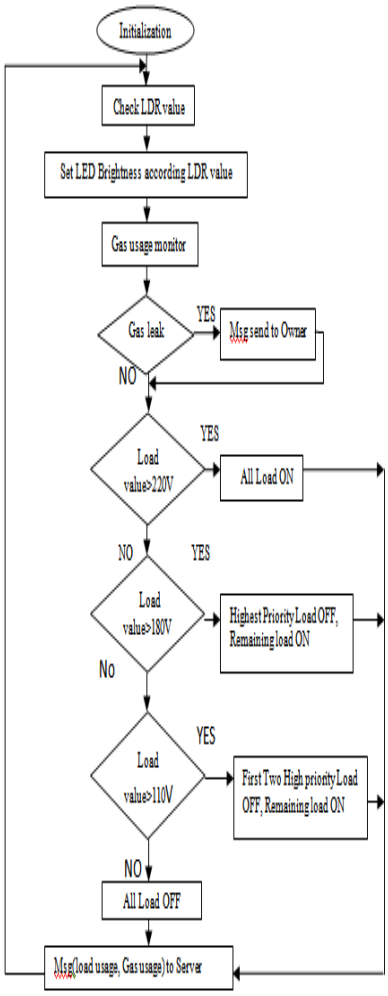

Figure.3 Flow Diagram

V. SIMULATION AND PERFORMANCE RESULTS

The Simulation model is shown in Figure.4.The simulation work is carried out for four different conditions in the case of automatic load management. power supply greater than 220v,greater than 180v,greater than 110v and less than 110v.According to the power supply level and load priority algorithm the loads will ON and OFF automatically. In the case of 220v and above all the loads will have enough voltage to perform their specific function. For intelligent light control strategy using LDR sensor can be represented as the light intensity increases the width of the PWM signal will also increases and the inverse occurs as the light intensity decreases. If there is any gas leakage, then there is a message will be displayed as "gas leakage detected". The result of simulation is as shown in Figure.5.

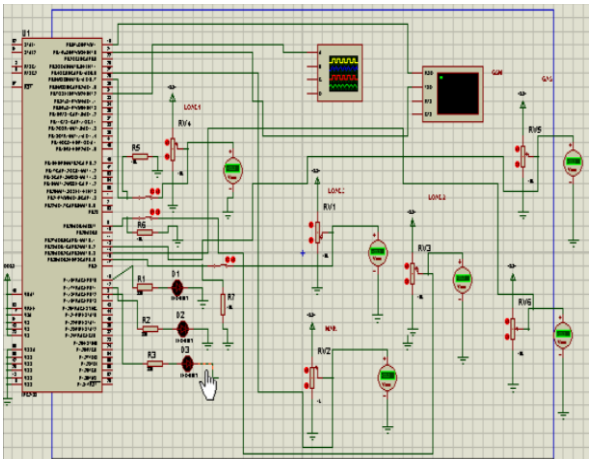

Figure. 4 Simulation Model

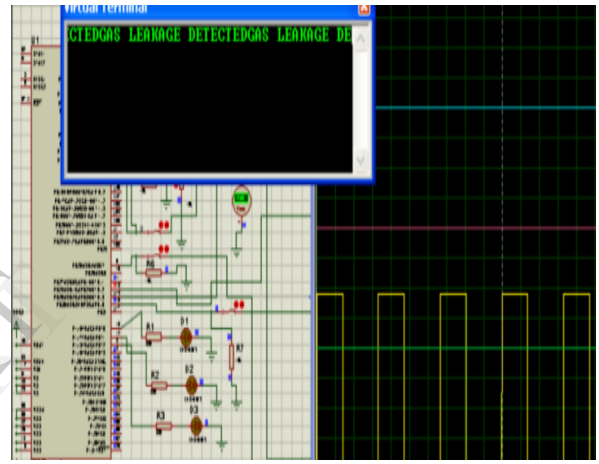

Fig.5 Simulation Results

VI. CONCLUSION

Considering the energy consumption in a household, home appliances account for a large portion of energy usage. The energy consumption of typical household appliances includes lighting, cooling and heating, and appliances. In this paper, different energy controlling techniques are discussed. Avoiding wastage of energy and adopting methods to efficiently save energy without impeding comforts and needs. The system minimizes energy consumption for the benefit of user and environment concurrently. These techniques reduce energy consumption by effective load management, automatic gas monitoring and automatic lighting control strategy. The advantage of proposed method is that it can automatically managing and monitoring the home appliances according to the situation.

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