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Automated Smart Home Control System

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Abstract— *In today's world of rapid technological growth the need for applying latest trends in all walks of life has become inevitable. So is the need for automated control of daily activities at homes grown to a greater extent. In order for smart homes to achieve their promise of significantly improving the lives of families through socially appropriate and timely assistance, they will need to sense, anticipate and respond to activities in the home. A novel method of smart home control is proposed encapsulating certain sensing techniques and power resources making it independent of commonly occurring power shutdowns.*
Keywords—Automation,Independent,Power resources, Power shutdwon,Smart homes.

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I. INTRODUCTION

An important goal of smart home research then becomes how to appropriately expand system capabilities to produce more control both perceived and actual. We suggest that the problem of home control should be widened to include all daily activities. In this paper, we discuss how a smart home might provide families with more control over their lives. We are suggesting that end-user consider not just the usability of the system, and how the users manage the things that constitute it, but what utility the system is ultimately responsible for delivering. Focused on avoiding unwanted wastage of power and providing uninterrupted and independent power resource smart home control system helps people overcome the daily short comings in terms of power.

Thus, the Home Monitoring and Control, enables real-time access to view and make changes to a home's lighting, security cameras, locks, and thermostats as well as appliances and consumer electronics connected to the home network. The system proposed is focused at implementing all the basic automatic home control at least possible cost suitable for middle class homes.

HOME automation system is a computerized, intelligent network of electronic devices, designed to monitor and control the home appliances and lighting systems in a building. It allows users to remotely monitor and control consumer electronics through the external network such as Internet. Home automation is the emerging field that has attracted the attention in both the commercial and research field. Although wired home networks were famous at the early developments of home automation systems, nowadays wireless communication is replacing the wired system which are very messy and also difficult to setup. It is the reason wireless communications are replacing the wired ones. Furthermore, wireless system provides more flexibility and extensibility. That is, its installation is free from construction works since it requires no cabling works. Although many of wireless network solutions such as Bluetooth, Ultra-Wide Band (UWB), Wireless Ethernet, and many more, are in the area of home networking ZigBee, a newly developing protocol for wireless sensor networks based on the IEEE 802.15.4 specification, has become the most trending technique in the research and commercial domains because of open standard, low-cost, and low power characteristics [1] - [3]. Therefore, compared to the other wireless technologies, ZigBee protocol is suitable for system environments, which demands less power consumption and lower data-rate requirements.

Any system requires a self-sustainable and reliable power source. Thermal power has been the major source of generating electricity. But the depletion of raw material and the various disadvantages have always made us to look for alternate, reliable and renewable power sources.

The two major power resources proposed as alternatives are

- Solar power and
- Wind power

II. SOLAR POWER

The Earth receives 174 petawatts (PW) of incoming solar radiation (insulation) at the upper atmosphere. Approximately 30% of it is reflected back to space while the rest is absorbed by clouds, oceans and land masses. The spectrum of solar light at the Earth's surface is mostly spread across the visible and near-infrared ranges with

a small part in the near-ultraviolet. Earth's land surface, oceans and atmosphere absorb solar radiation, and this raises their temperature. Warm air containing vaporized water from the oceans causes atmospheric circulation and convention.

The total solar energy absorbed by Earth's atmosphere, oceans and land masses is approximately 3,850,000 exajoules (EJ) per year. Solar energy can be harnessed in different levels around the world.

Solar energy can be used to heat water, dry clothes, heat swimming pools, power attic fans, power small appliances, produce light for both indoors and outdoors, and even to power cars, among other things. When you use solar energy, you and your home become independent of foreign or other sources of energy which raise costs quickly. Solar power is non-polluting. Unlike oil, solar power does not emit greenhouse gases or carcinogens into the air. Light and energy from the sun costs nothing. Once you purchase the equipment to collect and convert energy from the sun, it costs you nothing to run.

Solar energy does not cause pollution. However, solar collectors and other associated equipment / machines are manufactured in factories that in turn cause some pollution. Solar energy can be used in remote areas where it is too expensive to extend the electricity power grid.

Many everyday items such as calculators and other low power consuming devices can be powered by solar energy effectively. It is estimated that the world's oil reserves will last for 30 to 40 years. On the other hand, solar energy is infinite (forever).

This paper proposes a system for use of solar power as a primary source of power for homes thus eliminating the need for dependency and provision of uninterrupted power. Charges stored in batteries from solar panels are converted to AC supply using high power efficient inverters for home appliances.

The three most commonly used panels are:

- Monocrystalline solar panels
- Polycrystalline solar panels
- Amorphous solar panels

Average insulation showing land area (small black dots) required to replace the world primary energy supply with solar electricity. 18 TW is 568 Exajoule (EJ) per year. Insulation for most people is from 150 to 300 W/m2 or 3.5 to 7.0 kWh/m2/day.

The paper is organized as follows

Section 3 provides the structure of the proposed solar powered home automation system, Section 3.1 describes briefly about the automatic door control and Section 3.2and 3.3gives a short note on lighting and temperature control.

III. STRUCTURE OF PROPOSED SOLAR HOME AUTOMATION SYSTEM

Home appliances and furnishings are connected together to form a home network through various home networking protocols and communicating mediums in home. Home gateway can assist residents cooperating interactive operations of those appliances and furnishings. Then, it recreates a proper atmosphere according to residents' locations, situations and preferences. Finally, home residents can easily enjoy home services through autonomous operations of home gateway without any manned setting. However, which approaches can achieve living interactions between residents and smart home. These key issues can be accomplished by applying the context aware computing.

The proposed system structure Fig.1 consists of various sensors connected to different modules which are powered by solar panels through an inverter. The system also contains failsafe features to prevent the system from malfunctioning or getting damaged during extreme environmental conditions.

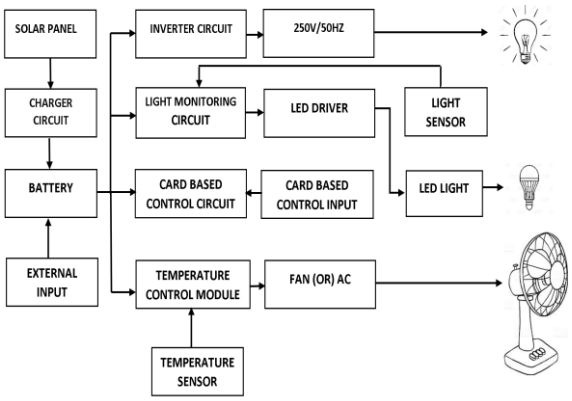

Figure.1 Structure of Home Automation System

The Battery is normally charged by the solar Panel. Analternative external power source is connected to the Battery as backup. The output of the Battery is given to inverter circuit and also supplies power to the light monitoring circuit, card-based controlcircuit, temperature monitoring and control circuit. The main device of an inverter is a transformer and the one used in this circuit is a step-up transformer. We use the power input as 12volts and the power output as 230V volts. This enables the system to power AC loads of frequency 50HZ.
The process of conversion of the DC current into AC current is based on the phenomenon of electromagnetic induction. Electromagnetic induction is generation of electric potential difference in a conductor when it is exposed to varying magnetic field.The transformer consists of two coils, namely primary and secondary coils. DC current is passed through one of them (primary coil) as shown in Fig.2, that coil with DC current can act analogously to the magnet (since electric current produces magnetic field). If the direction of the current is reversed frequently through a switching device, the alternating magnetic field will induce AC current in the secondary coil.This simple two-cycle scheme produces a square wave AC signal.

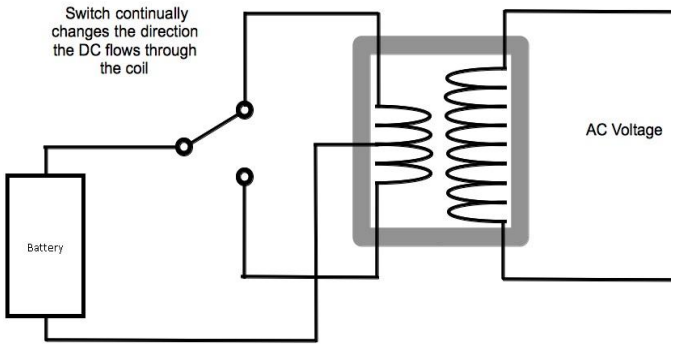

Figure.2DC to AC inverter circuit

The square wave can be modified further using more sophisticated inverters to produce a modified square wave or sine wave. To produce a modified square wave output, low frequency waveform control can be used in the inverter. This feature allows adjusting the duration of the alternating square pulses. Also, transformers are used here to vary the output voltage. Combination of pulses of different length and voltage results in multi-stepped modified square wave, which closely matches the sine wave shape.
Light monitoring circuit is connected to a light sensor and the LED Driver which controls the LED load connected. Temperature control module monitors the room temperatureand controls high power loads like a fan or air conditioner.

3.1SMART CARD BASED DOOR CONTROL

The proposed unique door locking mechanism aims at providing ultimate security implemented using four levels of lock control. The system uses different levels of analog locking mechanism in hardware.
The door control features include

- Multi analog locking using variable input
- Serves as key control to all other integrated systems.
- Quad locking with original switch

3.2 LIGHTING CONTROL

Unnecessary wastage of power occurs at home due to switch on of lights at times when not in use. Light control mechanism proposed here is aimed at reducing this unwanted power wastage by continuous monitoring of light intensity from external sources. “Lumen” is the unit of total light output from a light source. If a lamp or fixture were surrounded by a transparent bubble, the total rate of light flow through the bubble is measured in lumens. Lumens indicate a rate of energy flow.
Typical indoor lamps have light outputs ranging from 50 to 10,000 lumens. Lumens are used to order most types of lamps, to compare lamp outputs, and to calculate lamp energy efficiencies (which are expressed as lumens per watt). A large fraction of a lamp’s lumen output may be useless if it goes in the wrong directions.
“Foot-candles” and “lux” are units that indicate the density of light that falls on a surface. This is what light meters measure. For example, average indoor lighting ranges from 100 to 1,000 lux. The foot-candle is an older unit based on English measurements. It is equal to one lumen per square foot. It is being replaced by lux, a metric unit equal to one lumen per square meter. One foot-candle is 10.76 lux. Although foot-candles are now officially

obsolete, they probably will continue to be used because many existing light meters are calibrated in foot-candles. The general term for lux or foot candles is "illuminance."
The lux levels at various phases of a day and this lux monitoring done all throughout the day is used to control the home lighting system thus measuring the light available in a particular room.

3.3TEMPERATURE CONTROL

The temperature control system involves sensors installed in every room to constantly monitor the changes in temperature throughout the day and compare with a self-fixed threshold defined to be the set point. Actuators connected to these sensors switch on fans once temperature exceeds the desired set point thus gaining control over constant temperature maintenance.

- Sensor based room temperature control.
- Provision for automatic fan control when temperature exceeds desired limit

A home thermostat is an example of a closed control loop: It constantly assesses the current room temperature and controls a heater and/or air conditioner to increase or decrease the temperature according to user-defined setting(s). A simple (low-cost, cheap) thermostat merely switches the heater or air conditioner either on or off, and temporary overshoot and undershoot of the desired average temperature must be expected. A more expensive thermostat varies the amount of heat or cooling provided by the heater or cooler, depending on the difference between the required temperature (the "setpoint") and the actual temperature. This minimizes over/undershoot. This method is called Proportional control. Further enhancements using the accumulated error signal (Integral) and the rate at which the error is changing (Derivative) are used to form more complex PID Controllers which is the form usually seen in industry.

IV. CONCLUSION

Both pervasive and social networking systems are central to the development of systems for the future. While much work has been done on the development of pervasive systems the challenges are great and such systems are still in their infancy. Social networking on the other hand has taken off and is well established throughout the world. Integrating the two concepts is challenging but has potential for significant benefits for all. However, personalization and context awareness are key features that are needed for both types of system, and a major problem lies in how these should be handled. As we have seen, following a user preference rule-based approach, each user will have own set of user preferences and intent that can be used by the system to take decisions proactively to support. These may be learnt by monitoring the user's behavior and extracting patterns from it to monitor and to control a physical home and to bridge the interaction gap between the virtual and real-world device control mechanism. The developed system worked as an add-on and loosely coupled to the Second Life viewer. The animation and device control data were annotated in the virtual 3D object in Second Life. The 3D object representing a real device received inputs when interacted by a user and automatically responded with the state changes in the physical environment. We presented the implementation details of a preliminary prototype exploring the aforesaid Second Life based interactions in a real-virtual collaborative environment. In future we want to incorporate sound and gesture-based device control mechanism to provide intuitive interaction capabilities to the user in order to effectively control the Second Life viewer.

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