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Research Article

ENERGY SAVING THROUGH VIDEO PROCESSING - A SURVEY

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ABSTRACT

For saving energy through home appliances researches are going on in the embedded domain. We are proposing a system which processing the live video and detecting the movements in the area, by the way the power operated systems get controlled. In which the images are considered as matrix and the absolute difference between two matrix are considered. Based on the difference value, the movement is identified and the signal will be sent to the hardware control circuitry through DTMF (digital tune modular frequency). The hardware circuitry controls the switching action of the electronic appliances like air conditioner, fan and lights. Our proposed system will be an effective approach for power saving which will include the RTC (Real Time Clock) also, by the way the working time of the concern will be considered for the execution.

Keywords: Frame Differencing, DTMF, RTC, ACO, PSO, ANFIS, Genetic Algorithm, Neural Networks.

INTRODUCTION

Power saving have became a necessary thing in our day to day life. Growing interest in smart home (automated electrical controlled) is a way to offer a convenient, comfortable, and safe residential environment. In general, the smart home aims to offer appropriate intelligent services to actively support the household applicants such as light, fan, AC. Home power consumption is the largest portion of energy consumption in the world. Sometimes the frequent turn-on-off of the electrical appliances at a living room may be unnecessary, and thus we don't need to control the power of every appliance. But now and then the user leaves but forgets to turn off the electrical appliances. These factors cause energy loss. Sensors are used for automatic on and off of electrical appliances and these sensors consume more energy. Instead of using these ensures the Visual surveillance camera is used to gather information about the person and to detect the moving object. This camera is connected to hardware circuitry through DTMF. This recognizes the movement of the objects and it triggers the AC automatically. The (RTC) Real Time Clock is included by using this clock the whole operations will take place at working time. This paper presents design and implementation of power management system using user location, user motion detection and user living pattern in home networks[1-7].

PYROELECTRIC INFRARED SENSOR FOR INDOOR BASED SMART HOME

Smart home is expected to offer various intelligent services by recognizing residents along with their life style and feelings. One of the key issues for realizing the smart home is how to detect the locations of residents. The terminal -based method employs a type of device that should be carried by the resident while the non-terminal-based method requires no such device. Attention has been focused on location-based services as a way to offer high-quality intelligent services, while considering human factors such as pattern of living, health, and feelings of a resident. That is, if the smart home can recognize the resident's pattern of living or health, then home appliances should be able to anticipate the resident's needs and offer appropriate intelligent service more actively. In general, indoor location-aware systems have been classified into three types according to the measurement technology: triangulation, scene analysis and proximity methods. This paper is organized into two sections: first section is Architecture of the PIR sensor-based indoor location-aware system (PILAS), and the location-recognition algorithm and the next is Resident-detection method using PIR sensors, and evaluates the performance of the system under various conditions using an experimental test bed.

Framework of the smart home

Within this framework, the smart home server has the following functions.

1) The virtual map generator makes a virtual map of the smart home and writes the location information of the resident.

2) The home appliance controller transmits control commands to home appliances to provide intelligent services to resident.

3) The moving pattern predictor saves the current movement trajectory of the resident.

Location-recognition algorithm

The sensing area of each PIR sensor is shown as a circle, and the sensing areas of two or more sensors overlap. Consequently, when a resident enters one of the sensing areas, the system decides whether he/she belongs to any sensing area by integrating the sensing information collected from all of the PIR sensors in the room. Since the number of sensors and the size of their sensing areas determine the location accuracy of the PILAS, it is necessary to arrange the PIR sensors properly to guarantee the specified system accuracy. The location accuracy of this system differs according to the sensor arrangement, it is necessary to determine the optimal sensor arrangement that offers the greatest location accuracy.

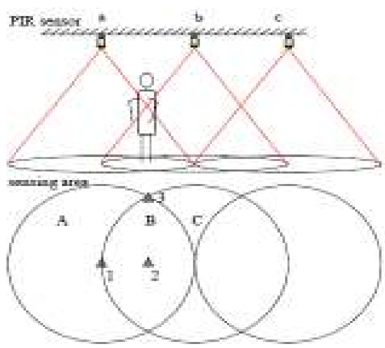

Figure 1: Resident-detection method using PIR sensors.

In order to enhance the location accuracy, it is also necessary to enhance the method of processing the PIR sensors using more advanced techniques such as probabilistic theories and soft computing. Finally, the proposed PILA system should be extended to deal with a room occupied by more than one residents.

MIDDLEWARE BASED LIVING PATTERN LEARNING FOR POWER REDUCTION

This paper presents the intelligent Power Management Device (iPMD), and the adaptive light-weight middleware so that it can be used with minimal power consumption for a wide range of applications. iPMD which will be installed in every power outlet in a home. iPMD detects if a human body enters the detection area or not. If there is no human body present, all controlled appliances are turned off and iPMDs help reduce standby power consumption. If there is, the iPMD detects the light intensity under the environment and maintains sufficient light by controlling the nearby lights. An iPMD transmits and receives the sensor data from nearby iPMDs so the IPG can control different lights and appliances in different regions. iPMDs also communicate with the lightweight middleware at an Intelligent Power Gateway (IPG) that adaptively reason the optimal power control by analyzing user living pattern from the sensing data from devices.

Home network based power saving

Home network systems which can be categorized into three types,

1) Context- aware system - Context-aware systems are the context modeling based on ontology and the service reasoning using the inference engines. However, these systems with the fixed context modeling and the predefined event processing are difficult to adapt to the dynamic service domains. The most conventional power management systems do not consider the dynamic user living pattern which is the crucial information for multi-device energy savvy applications.
2) Agent-based system - multi-agent systems are very useful towards an implementation of the Knowledge Plane in home networks. However, a centralized agent system will require the self-configuration with the interconnection with devices, systems, and networks and it also needs to set up the multi device applications on the intelligent devices in a distributed manner providing energy efficiency.
3) Service- oriented system - Home network systems, implemented by the previous middleware architecture and service domain, are only capable of offering the home automation services that merely control home appliances by static policies. A new multiservice home gateway with a full-fledged execution environment may lead the evolution of service and business models. In line with the new paradigm from domain-oriented service to user centric service it is required to resolve diverse service conflicts by the accurate service prediction.

Distributed Adaptive Power Control

Adaptive power management flow presenting key contributions as follows:

1) Dynamic iPMD an device registration - iPMDs are automatically registered at IPG based on its location in a plug and- play manner
2) User living pattern generation with power monitoring - IPG utilizes the learning mechanisms (e.g.Hidden Markov Model) which also take into account the user activities and the events before and after. On receipt of events, IPG generates the patterns, rules and the services for the energy QoS guarantee in accordance with the location, the iPMD status, and the power status.
3) Adaptive power control with rule update - **w**hen iPMD and device status change, IPG analyzes the updated power usage history then transmits the corresponding new power control rules to iPMDs. In order to predict the optimal service using the adaptive rules, iPMDs classifies the predefined and undefined events.

Distributed power control with iPMDs and a IPG presenting key contributions as follows

1) Location - aware iPMD clustering - IPG manages a set of IPMDs as a power control cluster based on their physical location. According to the location-aware clustering and the power consumption pattern-based rule generation, iPMDs interconnects with iPMDs which are located in same location.
2) Cooperative power control based on user activities - When an iPMD perceives the user movement or the power consumption, the iPMD requests the cooperation of power management service to clustered iPMDs.
3) Autonomous power control - An iPMD also can share the user location information by transmitting user location information message to nearby iPMDs, which make awake them from the sleep power mode and activate the lights or appliances nearby users.

Power consumption monitoring

This paper uses the PLC module to transmit and receive the data from each IPG to EPS via IRM to monitor and analyze the power usage patterns for each home. The request packet data format from IPG to IRM for power monitoring has four parts: the message type (1 byte), length (1 byte), customer ID (20 byte) and command (1 byte). The reply packet data format from IRM to IPG has four parts: the message type (1 byte), length (1 byte), customer ID (20 byte), command (1 byte), power meter constant (4 byte) and data (4 byte).

1) Intelligent Power Management Device (iPMD): Each iPMD has an integrated a PLC module to transmit and receive the data from IPG, hence IPG can control different lights in different regions.
2) Intelligent Power Gateway (IPG): IPG gets the sensor data by using the PLC module from iPMDs and sends control messages to iPMDs and other PLC enabled appliances. IPG aggregates the power consumption at each iPMD and periodically report it to EPS via IRM.
3) Intelligent Power Management Applications: It dynamically discover the list of iPMDs associated with the IPG and show the power consumption in various styles.
4) Integrated Regional Manager (IRM): An IRM communicates with an EPS via Ethernet in order to report the power usage patterns for each home.
5) Energy Portal Server (EPS): EPS facilitates overall power consumption management by configuring IPGs supporting autonomous remote configuration.

This paper concludes that the iPMD is used to monitor and manage the power control system and to generate control command. iPMD sends the sensing information to the Intelligent Power Gateway (IPG) and controls the standby power of attached appliances. Implementing iPMDs and IPGs and the experimental results demonstrate that in the proposed mechanism, standby power consumption of consumer electronics can be reduced up to 7.5% compared to existing power control mechanisms.

MULTIPLE HUMAN TRACKING AND IDENTIFICATION WITH WIRELESS DISTRIBUTED PIR SENSOR

In this system, the sensor field of view (FOV) is specifically modulated with Fresnel lens arrays for functionality of tracking or identification, and the sensor deployment is chosen to facilitate the process of data-object-association. An Expectation-Maximization-Bayesian tracking scheme is proposed and implemented among slave, master, and host modules of a prototype system.

The advantages of using wireless distributed pyroelectric sensor networks for multiple human tracking and identification include:

1) Reductions in the number of measurements and sampling frequency.

2) Reductions in hardware cost, power consumption, privacy infringement, computational complexity, communication overhead, and networking data throughput;

3) Reductions in the time of system deployment and limitations upon applications or application locations.

The challenges for tracking and identifying multiple humans with distributed pyroelectric sensors include:

1) High variability of human motions and their thermal biometrics;

2) Decreased sensitivity of a pyroelectric sensor when its lens apertures are reduced for modulation;

3) Errors in geometric optics modeling and system alignment;

The multiple human tracking component includes four parts: detection, localization/ data-object association, filtering, and prediction.

The multiple human identification component involves: feature selection and modeling, feature-to-object association, and data and decision fusion. The novelty of this work includes:

1) Developing pyroelectric sensor nodes suitable for multiple human tracking and identification;

2) Utilizing the sensor deployment geometry to facilitate data-to-object association;

3) Developing an expectation-maximization (EM) scheme to determine the number of objects under examination; and

(4) Performing information fusion at different levels for recognition accuracy improvement.

Multiple human tracking and identification are indeed two aspects of one problem.

1) Tracking
2) Identification

Bayesian Tracking

The multiple human tracking includes three problems:

1) Object number determination - A more challenging aspect of the multiple object tracking with multiple sensors is the data-to-object association when the number of objects varies. It becomes more intractable for motion sensor systems, which only respond to target motions and generate no signal when targets stand.
2) Measurement-to-object association - The key concepts of measurement-to-object association for a fixed number of targets are the joint event and the validation matrix.

Walker Recognition

This consists of three problems that are,

1) Statistical Feature Models,
2) Data Learning,
3) Hypothesis Testing.

Single Walker Identification

For single human subject identification, we used four type II sensor nodes. The human subjects randomly walk inside the room one at a time. For a real-number sequence, one can use principal component analysis (PCA) to extract features. Feature extraction can be performed at two levels: sample and feature.

Multiple Walker Identification

The signals generated by multiple subjects usually interfere and overlap with each other, making it difficult to extract feature sequences for each individual. But in this paper the exploit geometric advantages of distributed sensors are used, which are deployed in a way of forming several non overlapped sub detection- regions. Here, we use the terms of marginal and joint identification rates to describe the multiple human recognition performance.

This paper concludes that the prototype system can track two humans simultaneously in two typical scenarios. The multiple walker recognition problem using the concept of sub detection-regions formed by a specific global sensor FOV geometry. It can run as a standalone inmate/patient monitoring system under any illumination conditions, as well as a complement for conventional video and audio human tracking and identification systems.

LOW-FREQUENCY RESPONSE OF PYROELECTRIC SENSORS

This paper carried out the most important mechanisms of heat losses in the pyroelectric sensors, estimate their influence on the responsively, obtain the simple expression for a description of the main characteristics of the real systems, and determine the criteria of the validity of various models in the region of infra-low frequency spectrum.

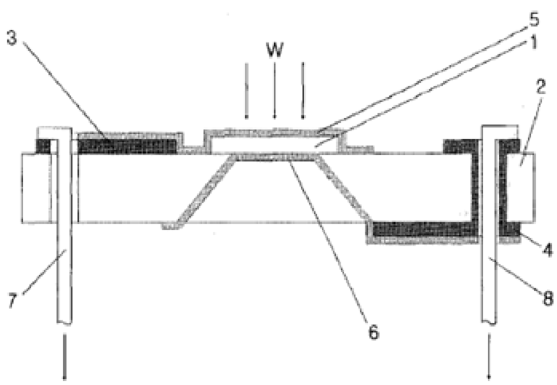

Figure 2: 1-pyroelectric plate; 2-dielectric substrate, 3,4-metal layers, 5,6-electrodes, 7,8- output leads.

Device Structure

The front surface of the crystal is heated by radiation flux W(t) = Woexp(iwl), that is periodically modulated with angular frequency w = 27rf. It produces a periodic temperature field Qj (z , t)=0, (x) exp(iwt), where j = 1, 2, 3 are the numbers of corresponding layers and d3 (z,t) = T3(z,t) - *To* is the deviation of the temperature of the jth layer, T3 (z, t) from the equilibrium temperature To.For a thin sensitive element of thickness 1 and area A, the pyroelectric voltage of an unloaded detector is given by:

$$V(t) = \frac{pl}{\varepsilon\varepsilon_o}\langle\theta_2\rangle exp(i\omega t)$$

where q (t) , (&), and p are the accumulated charge, spatially averaged temperature field, and the pyroelectric coefficient of the pyroelectric element, respectively, and E and EO are dielectric constants of the pyroelectric material and vacuum.High frequencies of modulation:

$$V1 \approx \frac{e_{1pWo}}{i\omega\varepsilon\varepsilon_0 c_2}$$

Small and intermediate frequencies:

$$V \approx V_0 \frac{1}{i\omega c_2 + 2\sqrt{i\omega K_{1\,c_1}/_{l+d}}}$$

The current response I and effective thermal conductivity

$$I \approx I_0 \;\; \frac{1}{c_{2\,l+2\sqrt{\frac{k_{1c1}}{i\omega}+\frac{d}{i\omega}}}}$$

where IO = elpWAo, and

$$Y_T \equiv \frac{e_{1AW_0}}{\langle\theta\rangle} \approx i\omega c_2 Al + 2A\sqrt{i\omega k_{1c1}} + Ad$$

The three main mechanisms of distribution of the heat energy between different parts of the system with three simple types of frequency response.

The upper part of the frequency region

$$Y_T \approx i\omega c_2\, Al$$

An intermediate w-lI2 part of' the voltage response:

$$V_2 \approx V_0 \frac{l}{2\sqrt{1\omega K_{1c1}}}$$

$$Y_{T2} \approx 2A\sqrt{i\omega K_{1c1}}$$

It exists only in the detectors with relatively thin sensitive element if inequality:

$$l < l_{23} \equiv \frac{4K_{1c1}}{d}$$

In the low-frequency range:Type equation here.

$$V_3 \approx V_0 \frac{l}{d}$$

Thickness of the sensitive element 1 is smaller than the length of thermal diffusion l2 = (2nLj~3)1/2T1h we neglect nonuniformity of axis-symmetrical distribution of temperature B(z, r) over the thickness of the sensitive element:

$$\theta(x, r) = \theta(r)$$

The bulk substrate as an ideal heat sink in comparison with large lateral heat resistance of thin sensitive element and neglect the temperature growth in the region of the substrate adjacent to the sensitive element:

$$\theta(r) = 0, \text{if } r > r_1$$

where r1 is the radius of the sensitive area. Temperature distribution Q(T, t) = Q(re)x p(iwt) in the sensitive element can be described by the axis-symmetrical heat conduction equation:

$$\frac{\partial\theta}{\partial r} + \frac{1}{r}\frac{\partial\theta}{\partial r} - \frac{1}{a_2}\frac{\partial\theta}{\partial t} = \frac{Q}{K_2}$$

It can be seen that only four different sequences of regions that are described below.

1-2-3**:** heating of the element (first type of response)- heat conduction of air (second type of response)- emission of radiation (third type of response);

1-2-4: heating of the element-heat conductivity of air-lateral heat conduction;

1-3: heating of element-emission of radiation;

1-4: heating of element-lateral heat conduction.

This paper users the common feature of all types of the sequences is the high-frequency region, in which heat loss from sensitive element are negligibly small. In the low frequency region, two possible mechanisms of heat loss can compete: emission of radiation and lateral heat loss. In the case of very thin sensitive element, the intermediate region of the frequency response can exist, in which the heat loss via thermal conduction of the air surroundings is predominant. In the opposite case, the low-frequency branch of responsibility is followed immediately by a high-frequency one.

DISCUSSION

Recent blackouts around the world question the reliability of conventional and adaptive power usage techniques in avoiding such power outages. To address this issue, reliable techniques are required to provide fast and accurate load shedding to prevent collapse in the power system. Computational intelligence techniques, due to their robustness and flexibility in dealing with complex non-linear systems, could be an option in addressing this problem. Computational intelligence includes techniques like artificial neural networks, genetic algorithms, fuzzy logic control, adaptive neuro-fuzzy inference system, and particle swarm optimization. Research in these techniques is being undertaken in order to discover means for more efficient and reliable power consumption devices. The optimization techniques used to control power usage in small home applications are Ant Colony Optimization (ACO) Aco, Particle swarm optimization (PSO), Adaptive Neuro-Fuzzy Inference system (ANFIS) optimization technique, genetic algorithm

1) Ant Colony Optimization (ACO) - In computer science and operations research, the ant colony optimization algorithm is a probabilistic technique for solving computational problems which can be reduced to finding good paths through graphs.
2) Particle swarm optimization (PSO) - it is a computational method that optimizes a problem by iteratively trying to improve a candidate solution with regard to a given measure of quality. PSO optimizes a problem by having a population of candidate solutions, here dubbed particles, and moving these particles around in the search-space according to simple mathematical formulae over the particle's position and velocity. Each particle's movement is influenced by its local best known position but, is also guided toward the best known positions in the search-space, which are updated as better positions are found by other particles. This is expected to move the swarm toward the best solutions.
3) Neural Networks - Neural networks are essentially non-linear circuits that have the demonstrated capability to do non-linear curve fitting. The outputs of an artificial neural network are some linear or nonlinear mathematical function of its inputs. The inputs may be the outputs of other network elements as well as actual network inputs. The most popular artificial neural network architecture for electric load forecasting is back propagation. Back propagation neural networks use continuously valued functions and supervised learning.
4) Adaptive Neuro-Fuzzy Inference System (ANFIS) – it is employed to model duct and pipe networks and obtain optimal differential pressure (DP) set points based on limited sensor information. A mix-integer nonlinear constraint optimization of system energy is formulated and solved by a modified genetic algorithm. The main feature of our paper is a systematic approach in optimizing the overall system energy consumption rather than that of individual component[8-11].
5) Genetic Algorithm (GA) - it is a search heuristic that mimics the process of natural selection. This heuristic (also sometimes called a metaheuristic) is routinely used to generate useful solutions to optimization and search problems. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover[12-14].

CONCLUSION

The paper describes the comparison and analysis between various methods involved in reducing the power consumption for smart home applications. It also illustrates that there are many optimization techniques that can be followed for power utilization. This kind of comparison reflects that the power use differs from each method. This paper shows the usage of effective approach for power saving.

REFERENCES

1. Samoilov VB and Yoon YS, Frequency response of multilayer pyroelectrics sensors, IEEE Trans. Ultrason., Ferroelect., Freq. Contr., 1998; 45(5): 1246-1254.
2. Sekmen AS, Wilkes M, and Kawamura K, An application of passive human-robot interaction: Human tracking based on attention distraction, IEEE Trans. Syst., Man, Cybern. A, 2002; 32(2): 248–259.
3. Lee KC and Lee HH, Network-based fire-detection system via controller area network for smart home automation, IEEE Transactions on Consumer Electronics, 2004; 50(4): 1093-1100.
4. Cabrer MR, Redondo RPD, Vilas AF, Arias JJP and Duque JG, Controlling the Smart Home from TV, IEEE Transactions on Consumer Electronics, 2006; 52(2): 421-429.
5. Joon H, Choong Seon H, Seok Bong K, and Sang Soo J, Design and Implementation of Control Mechanism for Standby Power Reduction, Consumer Electronics, IEEE Transactions, 2008; 54: 179-185.
6. Jinsoo H, Intark H, and Kwang-Roh P, Service-oriented powermanagement for an integrated multi-function home server, Consumer Electronics, IEEE Transactions on, 2007; 53: 204-208.
7. Prasanna S, Logeesan A. Automated Intelligent Power Saving System and Security System, Advance in Electronic and Electric Engineering. 2013; 3(9): 1167-1176.
8. Lalli G et al. A development of knowledge-based inferences system for detection of breast cancer on thermogram images. Computer Communication and Informatics (ICCCI), International Conference on. IEEE, 2014.
9. Lalli G., Kalamani D, and Manikandaprabu N. "A New Algorithmic Feature Selection and Ranking for Pattern Recognition on Retinal Vascular Structure with Different Classifiers. Australian Journal of Basic & Applied Sciences, 2014; 8: 15.
10. Lalli G et al. Feature Recognition on Retinal Fundus Image–A Multi-Systemic Comparative Analysis.

International Journal of Advanced Research in Computer Science and Software Engineering, 2013; 3(11): 427-434.

11. Lalli GD. Kalamani, and Manikandaprabu N. A Perspective Pattern Recognition Using Retinal Nerve Fibers With Hybrid Feature Set. Life Science Journal, 2013; 10: 2.
12. Manikandaprabu N, et al. Data Hiding in Color Images. Int. J. Novel. Res. Eng & Pharm. Sci., 2014; 1.05: 1-7.
13. Manikandaprabu N et al. FPGA Implementation of Image Optimization Algorithms - A Review. Int. J. Novel. Res. Eng & Pharm. Sci 1.05: 45-49.
14. Lalli G, Kalamani D and Manikandaprabu N. An ANFIS Based Pattern Recognition Scheme Using Retinal Vascular Tree–A Comparison Approach with Red-Green Channels. Journal of Theoretical and Applied Information Technology, 2014; 59: 1.

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