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Smart Home System

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Abstract— ***Smart home technology is emerging rapidly as an exciting new paradigm. A wide range of aspects that includes security, energy saving, ventilation, smart kitchen is covered in this paper. All of the above is executed with the help of smart devices such as remote control, security alarms, sensors etc. In this paper we present the above mentioned technologies and tools that can be integrated in smart home systems which can provide security energy saving and other such smart systems.***

Keywords— Smart home technology, Security alarm, Sensors, Remote Control, Energy Management, Smart Network

I. INTRODUCTION

Smart home is the integration of technology and services through home networking for a better quality of living. It uses different technologies to equip home parts for more intelligent monitoring and remote control and enabling them for influential harmonic interaction among them such that the everyday house works and activities are automated without user intervention or with the remote control of the user in an easier, more convenient, more efficient, safer, and less expensive way. In some cases, Integrating the home services as shown in fig. 1 [1] allows them to communicate with one another through the home controller, thereby enabling single button to control the various home systems according to preprogrammed scenarios or operating modes [2].

Smart homes have the potential to improve home comfort, convenience, security and energy management. Moreover it can be used for elder people and those with disabilities, providing safe and secure environments.

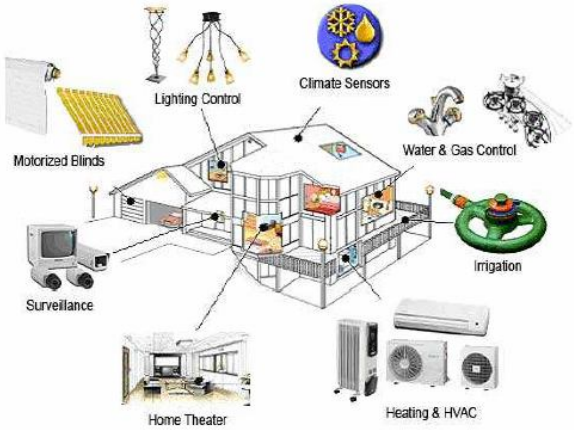

Fig.1 A Smart home Integration services

Section I is a brief definition of smart home and its benefits. Section II focuses on the Smart home technology. Section-III describes a case study of how smart home can reduce the energy consumption via managing intelligently the devices by controlling the lighting, air conditioning (HVAC) and other home appliances. In section IV, Conclusion and in Section V, References have been provided.

II. SMART HOME TECHNOLOGY

A. Smart home network

Smart home network technology can be classified into two main types, which are wiring system and wireless system. [3]In wiring system-here are many typesof wires that people may want to install in-wall. Many home-automations are connected through wiring system such as new wire (twisted pair, optical fiber), Powerline, Busline, etc. An example of outstanding technology is X10, which is open standard for home automation. X10 transmits binary data using the Amplitude Modulation (AM) technique. And X10 controllers send signals over existing AC wiring to receiver modules.

In the wireless system, there must have two main elements that are sender and receiver. Many new appliances use wireless technology to communicate with other devices. The example of wireless communication system are microwaves, Infrared (IR), radio frequency (RF), Wi-Fi, Bluetooth, IEEE 802.11, and so on. Furthermore, some of smart home network standard can work using both wiring system and wireless system. An example of wireless communication system for smart home is Z-wave, which is a reliable and affordable wireless home automation solution.

B. Smart home controller

Smart home controlling devices are used for managing the systems by sending data or signal to control the actuators. The examples of the controllers are not only the remote control,but they can also be smartphones, tablets (iPad, Galaxy tab), web browsers and Short Message Service (SMS).

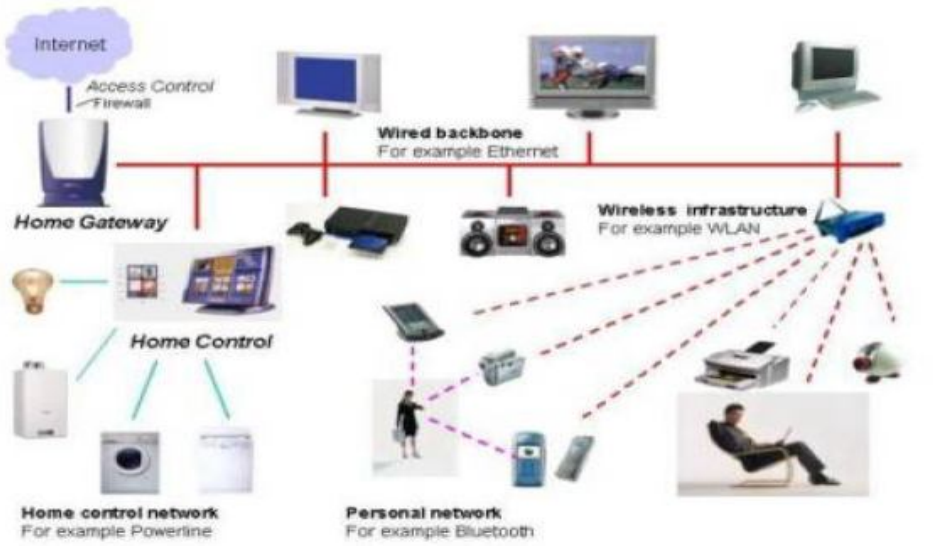

Fig. 2 Smart home network

C. Smart kitchen

Most intriguing application of smart technology is kitchen. For example, appliances which are smart are refrigerators, microwaves, coffee makers, and dishwashers. The Internet Refrigerator applies the technology of smarthome to make many works much easier. It is Internet enabled and allows users to communicate with it via the Internet, so it is able to download recipes and then display them on its LCD screen. Moreover, the refrigerator also takes an automatic inventory of items inside of it and it can alert the users to what is there. What's more, microwaves are also smart. Microwaves can communicate with smart refrigeratorsand suggest recipes based on the food items available in the refrigerator. The microwave can even be set to start at certain times while users are away from home. [4, 5]

D. Smart devices

The smart devices can be used in many aspects, for instance,

- *Welfare* - Health monitoring, personal trainer, remote diagnosis
- *Entertainment* - Television, video, games, Smart Home Theatre, Multi-Room Audio, HD Video Distribution
- *Environment* - Remote control of lighting, heating and air conditioning. Energy usage and cost.
- *Security* - Smart Security, simulated occupancy, property monitoring and protection, detection of fire, gas leaks and water leaks, tele-assistance.
- *Communication* - Video phone, home calendar, reminders and communication inside and outside the house.
- *Green* - Reduce Electricity(with the help of occupancy sensors)[7] and heating fuel consumption. Less Carbon Output.[6]

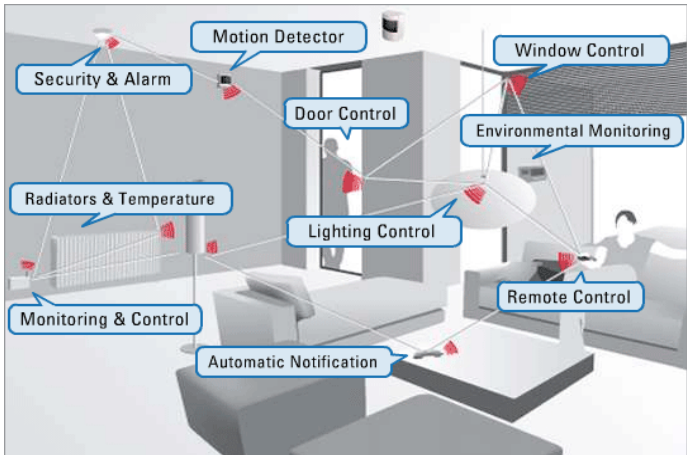

Fig. 3Examples of the Smart devices

III. Applications Of Smart Home Systems

A. Security

A security system such as canary adapts to your home overtime and sends intelligent notifications with HD video directly to your smartphone.

B. Energy Management

One of the major benefits of smart home to consumers is their ability to incorporate energy management features through lighting, air conditioning and home appliances.

C. Lighting

The lights in a smart home can be turned on and off automatically based on occupancy sensor. As example , when a person enters a room in the day time, the system will open the drapes instead of turning on the lights, but at night it would make sure the lights came on and they turned off when no one is in the room hence waste of energy can be preserved.

D. Air conditioning

An appropriate placement of temperature sensors and the use of heating and cooling timers can reduce the energy used and hence saving money and also the house can set to turn off air conditionings when no one is in the room.

E. Home Appliances

Smart homes can even go further in energy management by keeping track of the energy usage of each and every appliance in the house. The smart house controllers could schedule theoperation of heavy power consuming appliances (such as dishwashers and electric water heaters) to take maximum advantage of off peak electric rates. [8]

IV. Case Study

A detailed study of energy management is described in this paper and is reviewed from Dr.HamdyAshour et al.[7]Fig. 4 shows the apartment which consists of 6 rooms. Their dimensions are listed in table I.

Distribution of sensors is in such a manner that accurate information about the occupant's location and activity is provided. Occupancy Sensors are preferred instead of motion sensors. Fig. 5 describes examples of the two types of occupancy sensors distributed into the model. The first one is a passive infrared (PIR) sensor that automatically controls lights by detecting theheat from occupants moving within an area (900 square feet) to determine when the space is occupied with a low cost [10].The other, is used to adjust the temperature and lighting levelaccordingly for better energy management with a high cost [7] .Table II illustrates the number of sensor used per room and their distribution through the apartment is shown in fig. 4.

Fig. 4 : Layout of apartment indicating the distribution of sensors used (Sweet Home 3D software)

TABLE I
SIMULATED HOME AREA

Total	129
Kitchen	16
Dining Room	16
Bathroom	16
Room	48
Bedroom	25
Entrance Halls	S
Rooms	Area/m:

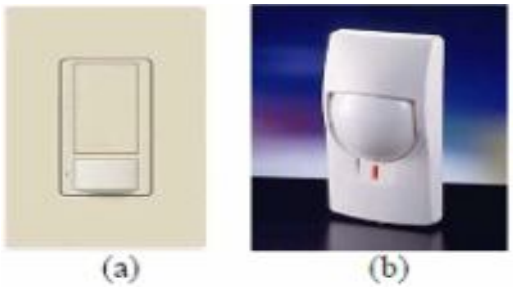

Fig. 5 : (a): Occupancy sensor for lighting
(b): Occupancy sensor for lighting and HVAC

TABLE III
LIST OF SENSORS PER ROOM

Total	3	3
Kitchen	1	0
Dining room	0	1
Bathroom	1	0
Living room	5	1
Bedroom	0	1
Hall	1	0
Target	Light control	Light+HVAC

In a proposed Scenario- A lot of sequences can be implemented according to the habitant's age and its social status. A scenario for an elderly house holder who has a high risk of falling down is proposed in [9]. Furthermore, a scenario for an individual gets back at evening and leaving in the morning is suggested in [10]. In this paper a scenario for a man and his wife getting back home and leaving in morning is presented.

TABLE IIII
PROPOSED SCENARIO

Wrong Behaviors	Action	Husband	Wife	Time	
	Hall is On		Back home	At 14 o'clock	1
Hall is left on for 30 minutes	Bedroom is On		Enters bedroom	14-14:30	2
	Hall is Off			At 14:30	
Bedroom is left on for 30 minute s	Bathroom is On Bedroom still On		Enters bathroom	14:30-15	
	Bathroom bedroom Off			At 15 o'clock	
Living room is left on for 2 hours	Kitchen is On Living room is On		Enters kitchen	15-17	4
	Hall is On	Husband back home		At 17 o'clock	
	Living is On Bedroom is On	He enters bedroom	waiting her husband in living	17-17:30	6
	Hall is Off			At 17:30	
Bedroom is left on for 30 minuets	Bathroom is On Bedroom still On Living is On	He enters bathroom	still waiting her husband in living	17:30-18	7
	Bathroom. Bedroom Off			At 18 o'clock	
Dining room is left on for 30 minutes	Kitchen is On Dining is On Living is On	He is waiting her into living	Enters kitchen to prepare launch	18-18:30	8
	Dining is On	They enter the dining room for launch		18:30-19	9
Dining room is left on for 1 hour	Kitchen is On Dining room still On Living room is On	waiting her into living room	Enters the kitchen	19-20	10
	Kitchen Dining room Living room are Off			At 20 o'clock	
	Bedroom is On	They enter bedroom		20-21	11
	Living is On	They enter living room		21-23	12
Dining Room is left on for 1 hour	Kitchen is On Dining is On Living room is On	waiting in dining room	Enters the kitchen to prepare dinner	23-24	13
	Kitchen is Off Dining room is on	Enter the dining room for dinner		24-24:30	14
Dining Room is left on for 30 minutes	Kitchen is On Dining still On	Back to living room	Enters the kitchen	24:30-1	15
	Dining room Kitchen Living are Off			At 1 o'clock	
	Bedroom is On	Back to bedroom to sleep		1-2	16
	All rooms are Off			At 2 o'clock	

Each room is simulated using DIALux software to calculate the power required for lighting. The air condition capacity was calculated according to the Canadian standards[10]. The home appliances capacity was calculated according to the U.S. Department of Energy's Office for Energy Efficiency and Renewable Energy (EERE)[7].

The results shown in fig. 6 confirm that the proposed energy management smart home can be adapted each time the occupant's habit change and thus the saving target.

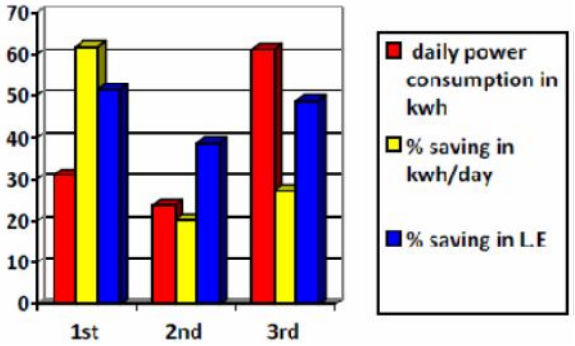

Fig. 6 : Layout The daily consumption, percentage saving in power and in electric bill for the previous trials.

V. CONCLUSION

This paper is based on the meaning of smart home and the details of smart home elements. In this paper a home energy management is presented which is based on a set of sensors to minimize the domestic energy waste according to human habits. The home power consumption is calculated and the rooms lighting are simulated using software. The results are satisfactory and indicate that smart home based on a set of sensors could perform energy management which is not only an individual need but economical target[7].

REFERENCES

[1] http://get-fuse.com/home automation.php
[2] R. Robles and T. Kim Applications, Systems and Methods in Smart Home Technology: A Review, International Journal of Advanced Science and Technology, Vol. 15, February, 2010.
[3] Li Jiang, Da-You Liu and Bo Yang, "Smart Home Research", 2004, Proceedings of the Third International Conference on Machine Learning and Cybernetics, August26-29, Shanghai, pp. 659-663.
[4] Manfred Huber, 2006, "Smart Home Technologies" [Online], Available: http://ranger.uta.edu/~huber/cse4392_SmartHome [2012, October 18].
[5] Barthold, Jim, 2005, "Changing the Way Houses Operate" [Online], Available: http://articles.castelarhost.com/smart_home_technology.htm [2012, October 18].
[6] ChristofferBjörkskog, "Human Computer Interaction in Smart Homes", Helsinki, Finland, p.1.
[7] Prof.Dr.HamdyAshour, Energy saving through smart home, The Online Journal on Power and Energy Engineering Vol-(2)-No.(3)
[8] *M. Kawidean, M.Kassim,* design development and implementation of smart home systems using RF and power line communication , The 2nd National Intelligent Systems And Information Technology Symposium (ISITS'07), Oct 30-31, 2007,ITMA -UPM, Malaysia.
[9] Y. Rahal, H. Pigo t, and P. Mabilleau, Location Estimation in a Smart Home: System Implementation and Evaluation Using Experimental Data, International Journal of Telemedicine and Applications, Vol. 2008.
[10] http://oee.nrcan.gc.ca/publications/infosource/pub/roomaircond/pdf/AC e Worksheet 04.pdf

