Smart Home Design Using ZigBee IEEE 802.15.4

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Abstract

Smart Home system provides independent and smarter life for human being (i.e.) it is human friendly in nature. Smart Environment is designed in order to save energy and provide facility without intend of getting input from the user. Body Sensor Network integrated with the Smart home gives a healthy smart environment. IEEE 802.15.4 ZigBee protocol is used for the healthy assisted Smart home design. This paper proposes a Health assisted Smart Home which focuses on health and energy consumption of the smart home.

Keywords: *Smart Environment; IEEE 802.15.4 ZigBee; BSN (Body Sensor Network); Smart Home;*

1. Introduction

The Development in intelligent system caused a massive research in design of smart environment. Smart environment design aims in improving the quality of life and his or her needs without disturbing the person. The smart environment reduces the input from the person without getting input from the person. The input of the system is detected from the sensors, Body Sensor networks etc without disturbing the person. Tremendous progress in Sensor networking, low power embedded system, Body sensor network, made the design of Smart environment in a smarter way [1, 2, 3, and 4].

2. Smart Home

Smart Home Environment (SHE) is the integration of technology and services through home networking for a better quality of living [5]. This smart home technology will become part of the environment in which people fulfill their tasks and in which people live. People needs are increasing now-a-days. To compensate these needs; applications are to be integrated with smart environments [6, 7]. Those applications should be human friendly i.e., the application should provide comfort and pleasure by without disturbing the user. The objective of this paper is to provide the notion of smart environments using body sensor network and through ZigBee IEEE 802.15.4 [8,9 and 10].

2.1. ZigBee

ZigBee mainly aims on providing low data rate based protocol design and it provides tiny stack [11]. It provides interoperability with the power balancing cum mobility for the user. ZigBee design is very much useful in body sensor network application for transmitting data from BSN to the Base station. ZigBee is extended to the internet and the data is processed [12].
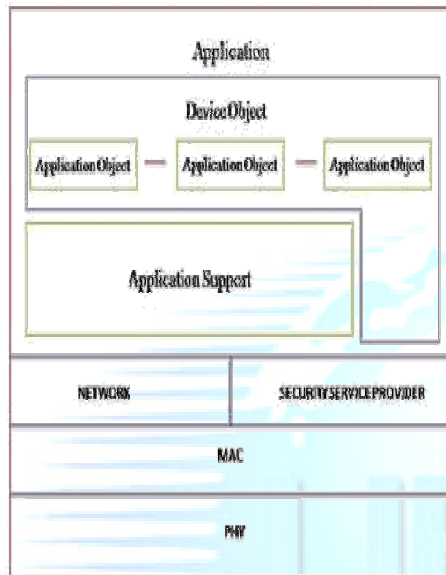
2.2. ZigBee Architecture

Figure 1. ZigBee architecture

3. System Model

Occupancy sensors and Body sensor network is used to find the presence of man and act accordingly as per the given algorithm. The system model mainly focuses on the Health assistance using home appliances such as Coffee machine, Exercise machine. The parameters for the coffee machine and exercise machines are set up in a smarter way as per the algorithm. The appliances are activated and controlled accordingly.
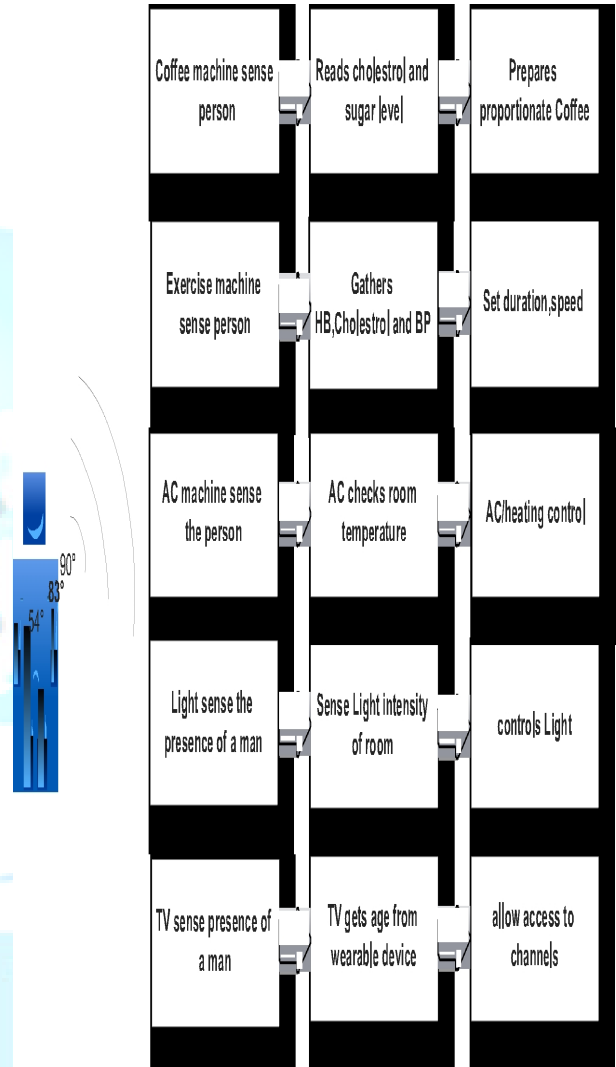

Figure 2. System Model

3.1. Algorithm

Energy Cum Health Assisted Smart Home

Input: PID →Person id,
OS →Occupancy Sensor,
T_B →Body Temperature,
T_E → Environmental Temperature.
A →Age,

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HB →Heart Beat,
Ch →Cholesterol level,
S → Sugar Level.

Output: LC → Light Control,
AC →Air Conditioner/Heater control,
 TC →Temperature Control,
TVC → Channel Control in TV,
PC → Proportional Coffee,
PE → Parameters in Exercise Machine

Begin Process

        If (OS==1)
           Begin branch
              If (time==op Level1)
                  LC=ON;
              Else
                  LC=OFF;
        End branch
           Begin branch (T_B, T_E)
              While $(T_B \&\& T_E = op Temp)$
                AC ="Set Value";
              End
        End branch
        Begin branch (Ch, S)
              While (Ch, S)
                 PC (S, Ch);
              End
        End branch
        Begin branch (HB, Ss, Ch)
              While ()
                PE (HB, S, Ch);
        End branch
           Else
              Rescan ();
End process
LC → Light ON,

opTime,

AC → Air Conditioning/Heater Control,

opTemp;

Flow TVC → TV ON,

Channel Access;

PC → Proportional (Milk, Coffee Essence, Sugar);

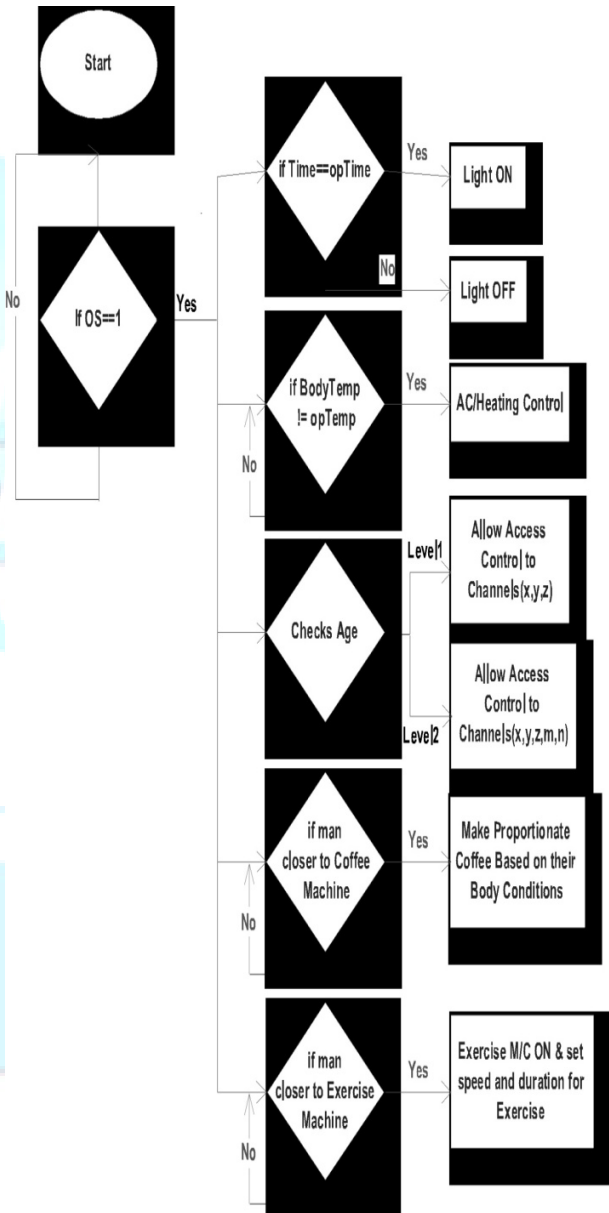PE → Parameter (Speed, Exercise Duration);

3.2. Flow Chart

Figure 3. Flow Chart

Ptolemy helps in modelling and designing concurrent, real-time embedded system. Ptolemy is java based simulator [13], [14]. Proposed system

model is modelled using Ptolemy 8.0.1 here the coffee machine bulb television Air Conditioner, Exercise machine are being modelled using the IEEE 802.15.4 ZigBee architecture. When the Person X goes near by the exercise machine it responds and sets parameter as per the output of the ZigBee output of Person.
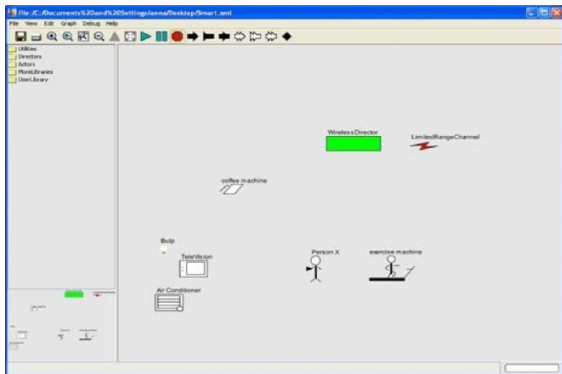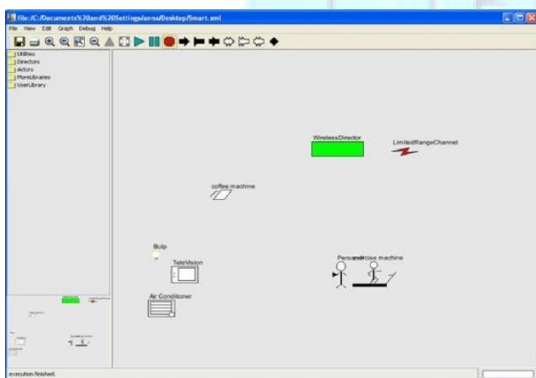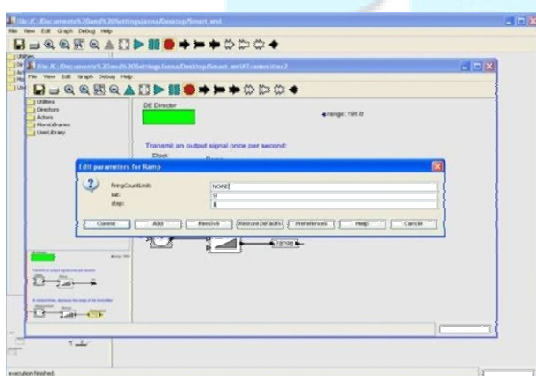

Figure.4

Figure.5

Figure.6

Figure 6 represents Person X standing away from the exercise machine which doesn't respond when he is away. Figure 5 represents Person X nearby exercise machine and the exercise machine responds and set's the parameter accordingly.

4. Conclusion

Though the basic advantage of this paper is to conserve energy and put it to optimum use, the same can be extended in various other forms also. In this way it is possible to manage the power consumption of the power system leading to an overall reduction in consumption and costs. Future works include handling hybrid body sensor networks for multiple target tracking, and to extend to more advanced optimization techniques.

References

[1] Heemin Park, Jeff Burke, Mani B. Srivastava, Intelligent Light Control using Wireless Sensor Networks for Media Production, KSII Transactions on Internet and Information Systems, vol. 3, no.5, pp. 423-443, Oct. 2009.

[2] IEEE Computer Society, Low-Rate Alternative PHY Task Group of IEEE 802.15.4 (TG4a) for the ranging and location, IEEE 802.15.4a- 2007.

[3] Valero.M.A, Valillo.L, Penalval.A, AN Implementation Framework for Smart Home Telecare Services, Future Generation communication and networking (fqcn 2007), vol. 2, pp.60-65, Dec. 2007.

[4] Gislason, ZIGBEE Wireless Networking,ISBN-978-0-7506-8597-9,Elseiver-8=2008. Singhvi.V. et al, Intelligent light control using sensor networks, SenSys '05, 2005

[5] Singhvi.V. et al, Intelligent light control using sensor networks, SenSys '05, 2005.

[6] Valero.M.A, Valillo.L, Penalval.A, AN Implementation Framework for Smart Home Telecare Services, Future Generation communication and networking (fqcn 2007), vol. 2, pp.60-65, Dec. 2007.

[7] Akyildiz .I. F., Su. W. J., Sankarasubramaniam.Y. Cayirci.E. Wireless sensor networks: a survey Computer Networks, vol. 38, pp. 393– 422, Oct.2002.

[8] Wei Yuan, Xiangyu Wang, Jean-Paul M.G. Linnartz, A Coexistence Model of IEEE 802.15.4 and IEEE 802.11b/g, IEEE Symposium on Communications and

Vehicular Technology, Nov. 2007.

[9] Roy.A, Das.S.K, Basu. K, A Predictive Framework for Location-Aware Resource Management in Smart Homes, IEEE Transaction on Mobile Computing, vol.6, pp.1270-1283, Nov. 2007.

[10] Changsu, Suh. Yong Bae, Ko.Design and Implementation of Intelligent Home Control Systems based on Active Sensor Networks IEEE Transactions on Consumer Electronics, vol.54, no.3, Aug. 2008.

[11] ZigBee Alliance, ZigBee Specification. version1.1, Nov.2006.

[12] ZigBee Alliance, Smart Energy Profile Specification, version1.0, March.11.2009.

[13] IEEE Computer Society, MAC and PHY Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs), IEEE 802.15.4 TM-2003.

[14] http://www.eecs.berkeley.edu/Pubs/TechRpts/2007/EECS-2007-129.pdf

[15] Yamazaki.T., Ubiquitous Home, International Journal of Smart Home, vol. 1, no. 1, pp. 17-22, 2007.