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Green Living and Smart Home Control For Quality Living

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Smart Grid

- Two Way Communications
- Information Management
- Demand Response – Home Area Network
- ALL for green living
- ……

Home Area Network

- Home Automation
- Office Automation
- Building Automation
- ……

Demand Response

- **The need for Smart Home / Office / Building Control**

Smart Cities, Smart Living

- "smart city" ~ highlight the growing importance of Information and Communication Technologies (ICTs), social and environmental capital in profiling the competitiveness of cities

- Smart(er) cities have also been used as a marketing concept

Policy

- **research has also been carried out on the role of human capital/education, social and relational capital and environmental interest - important drivers of urban growth**

Characteristics

-
- **Strategy to create a competitive environment**
- **Sustainable cities**

Key questions

- Who are the main home automation market players?
- What is the market size for Home Automation?

Target Audience

- Home Automation solution providers
- Broadband service providers
- Network operators including cable, wireline, and cellular
- System integrators and professional service providers
- Home builders and building automation companies

Smart Home Market

- **Smart Home technology integrates HVAC (Heating Ventilation and Air Conditioning), Lighting, Curtains, Door Locks, ... etc.**

- **Traditionally, integrated system automated and controlled via a central unit either mounted on a wall or by remote controlled devices – need new technologies**

Smart Home Market

- Allows harmonized and customized controls
-
- Smart Home technology allows effective communication between devices
- A perfect Smart Home gives the benefits of comfort, convenience, energy savings, entertainment and security.

Home Automation

- **Number of Home Automation Systems to Hit 4 Million in 2013**

- **Study says home automation market to grow more than 50 times its current size.**

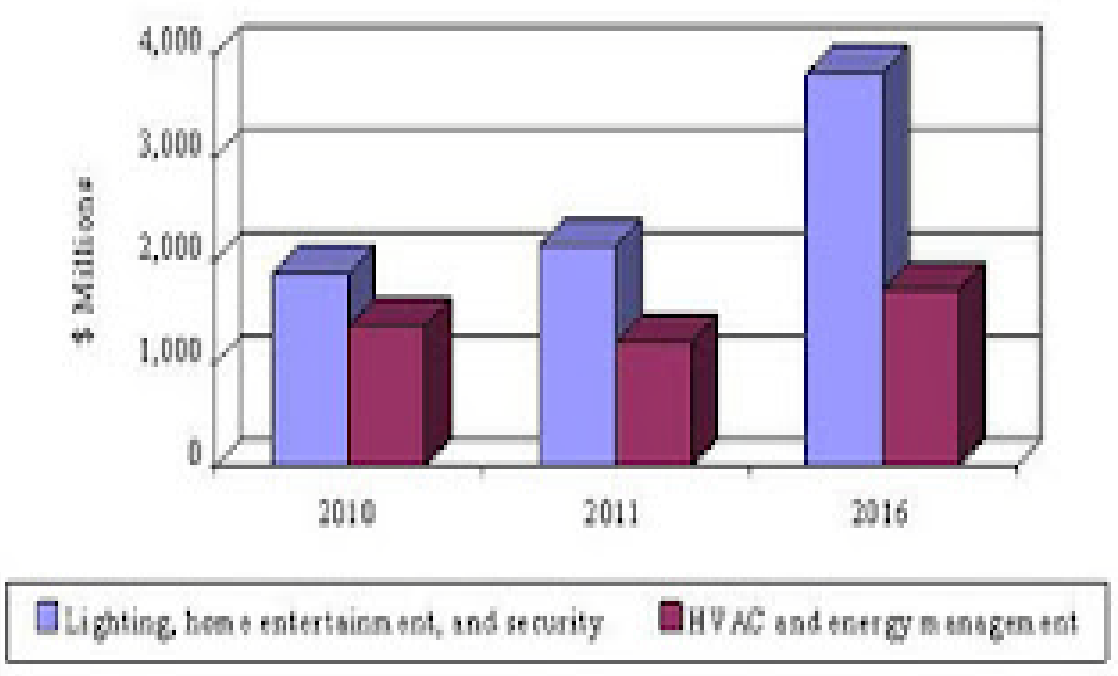
Home Automation

U.S. market :

- **worth approximately $3.2 billion in 2010**
- **expected to grow to almost $3.4 billion in 2011**
- **expected to exceed $5.5 billion in 2016**

Home Automation: USA Market

- **U.S. HOME AUTOMATION MARKET, 2010–2016 ($ MILLIONS)**

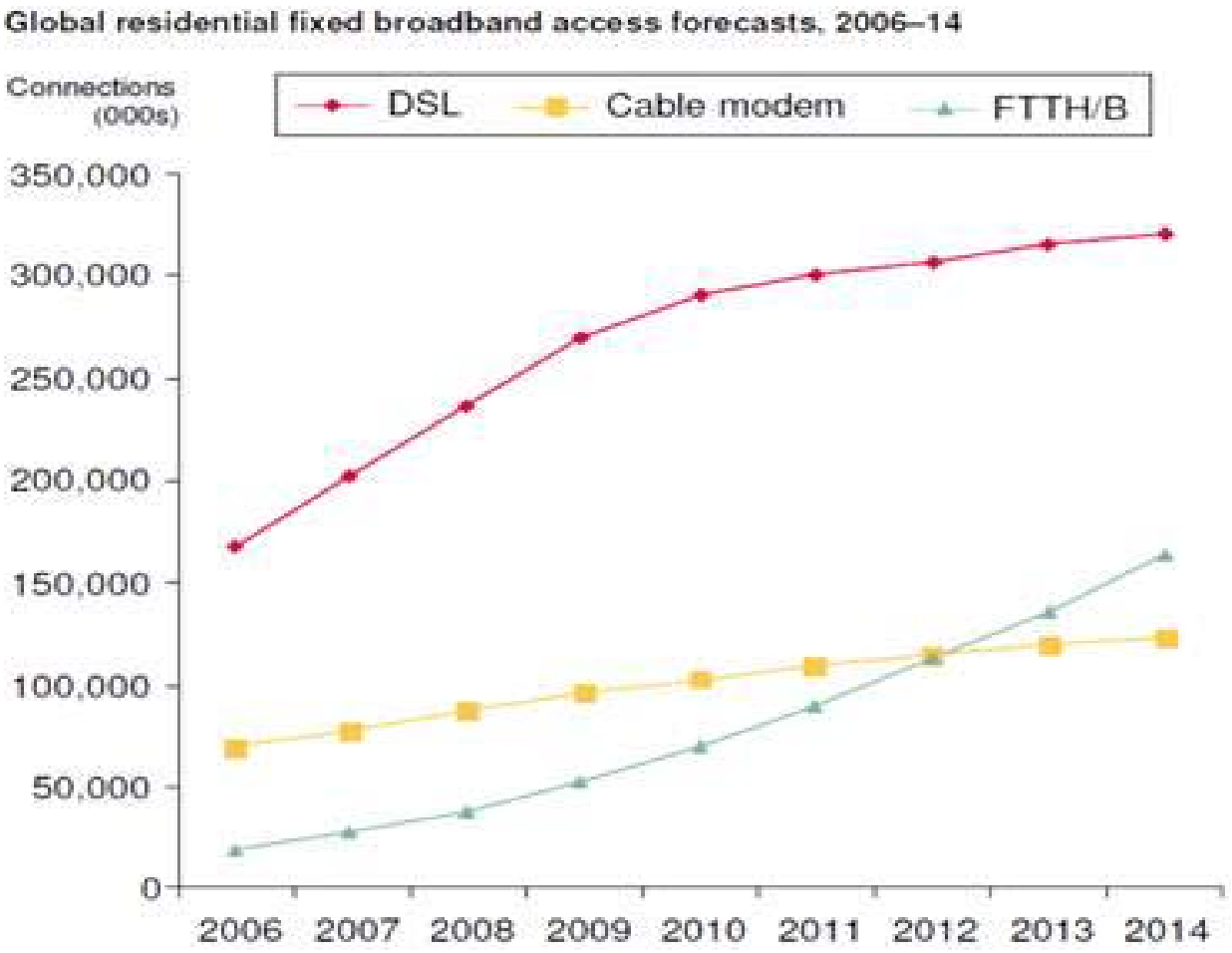


- BCC Research

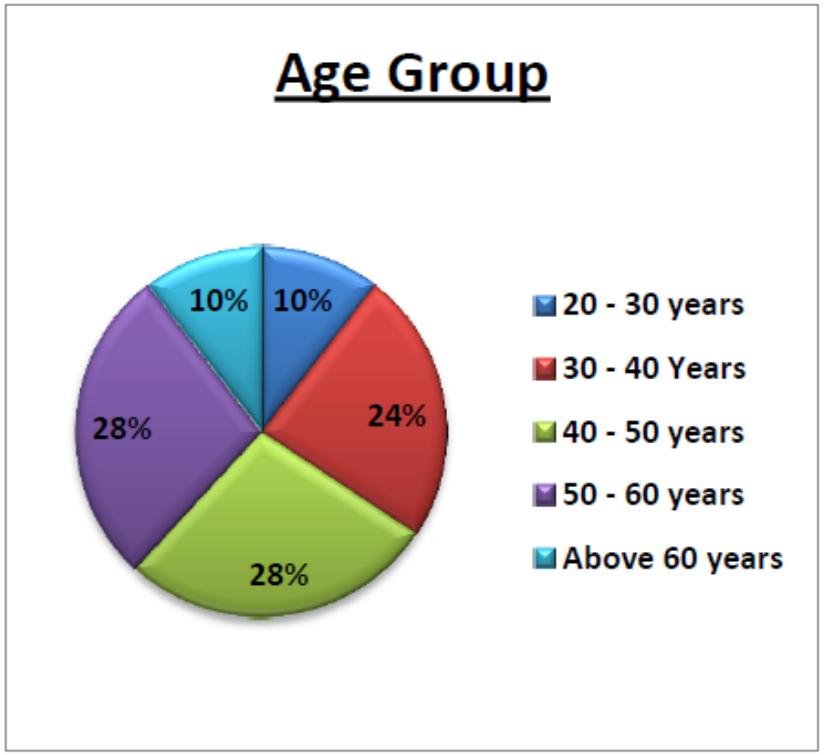
Home Automation in Dubai

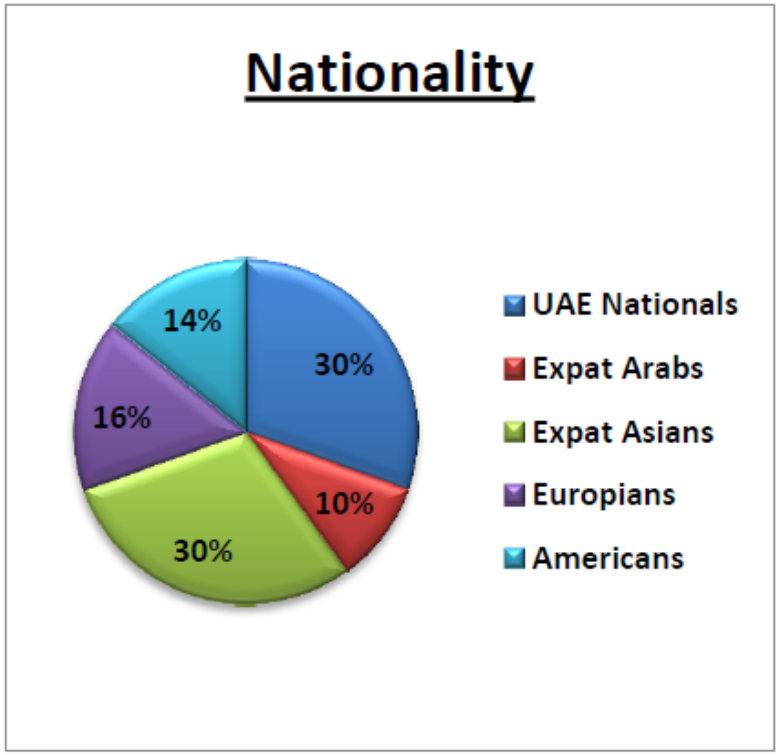
- **Successful experience from Dubai**

Smart Home Market in Dubai

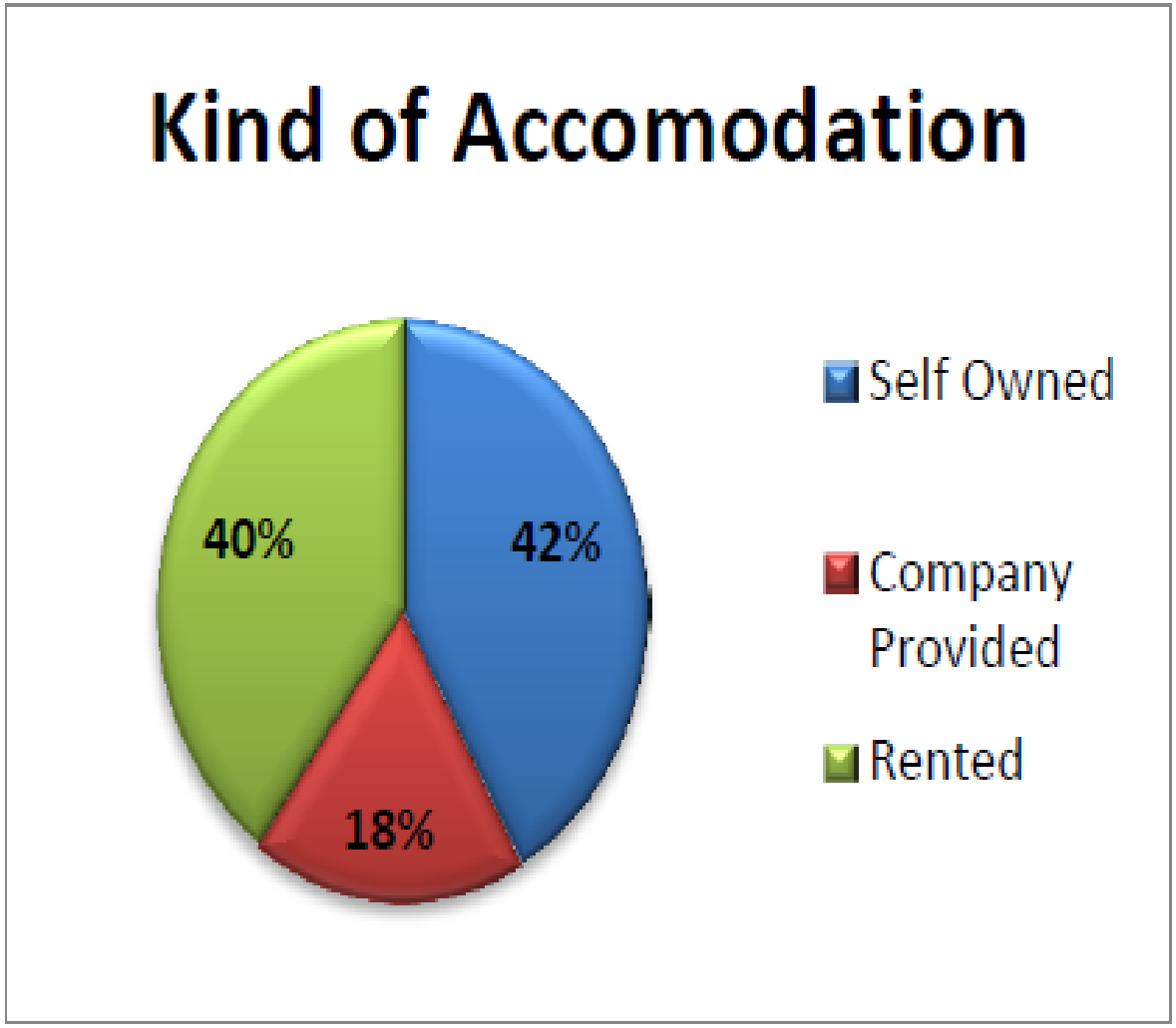


Age group and Nationality

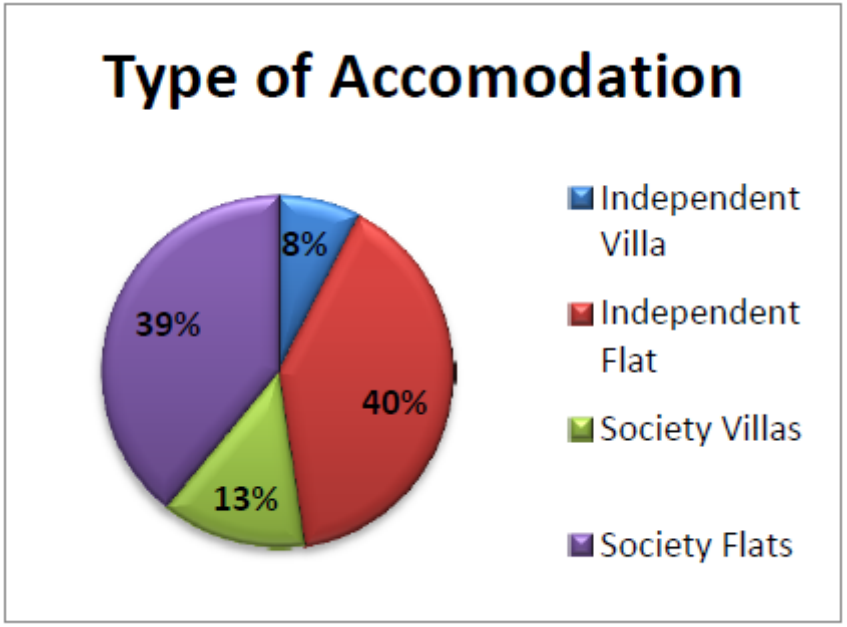




Accomodation



Type of Accomodation



Findings

- **“Ease of Use” is the most important factor**
- **Next most important factor : “Value For Money”**

Findings

- People prefer to have a single unified controlling entity for the entire house to control all features

- Desire to monitor and control the house remotely via the use of Smartphones and internet

Broadband users in Hong Kong:

- Size: 4,920,255
- Penetration: 69.40%

Home Automation in Hong Kong

- Still not certain, but believed that it has begun
- Need to work harder to analyze it's characteristics and explore what is needed
- Expect wireless solution will be one of the key players

What is good for Hong Kong

- **What factors to be considered ??**

Factors influencing Home Automation

- Compatibility with existing appliances
- Ease of Use
- Cost of solution
- Variety of packages
- Customizable / Flexibility
- ……

Elements for successful automation

- Remote Access from Internet/Smart Phone
- HVAC Automation
- Lighting Automation
- Curtain Automation
- Security Automation
- Entertainment Automation
- Preferred payment, solution, ...
- Awareness: Newspapers, TV, Radio, word of mouth, ...

Classifications of domestic network technologies

- many attempts to standardize the forms of hardware, electronic and communication interfaces needed to construct a home automation system

- Some standards use additional communication and control wiring : PLC, wireless, wired, ……

Wireless Home Automation

- **Why wireless ??**

Benefits of Wireless Home Automation

- Control wiring is hardest to retrofit into an existing house
- Wireless sensor and actuator networks all around
- Wireless home automation networks enable monitoring and control applications for home user comfort and efficient home management

Benefits of Wireless Home Automation

- low-power RF transceivers offers mobility
- RF communication allows flexible addition or removal of devices to or from the network and reduces installation costs (cf: wired solutions require conduits or cable trays)
- Challenges: dynamics of radio propagation, resource limitations, mobility of some devices , …..

Potential technologies

- ZigBee , Zwave, ...

Home Automation Network System

- **Require low energy !!**

Wireless Home Automation Network System

- ZigBee –
- a low energy solution is adopted

Zigbee

- **ZigBee : high level communication protocols using small, low-power digital radios**
- **Conform to IEEE 802 Low-Rate Wireless Personal Area Network (WPAN)**
- **Currently, ZigBee is mainly applied to control devices, e.g. wireless light switches, electrical meters with in-home-displays**

Zigbee

- a radio-frequency network : low-cost, low-power and secure networking
- can be widely used
- low-power allows smaller batteries with longer life
- mesh networking provides high reliability and robustness with extensive range.
- Maximum data rate: 250 kbps: caters for both periodic data and a single signal transmission from a sensor or input device
- ZigBee operates in the industrial, scientific and medical (ISM) radio bands
- 2.4 GHz is most popularly used worldwide.

Device Type

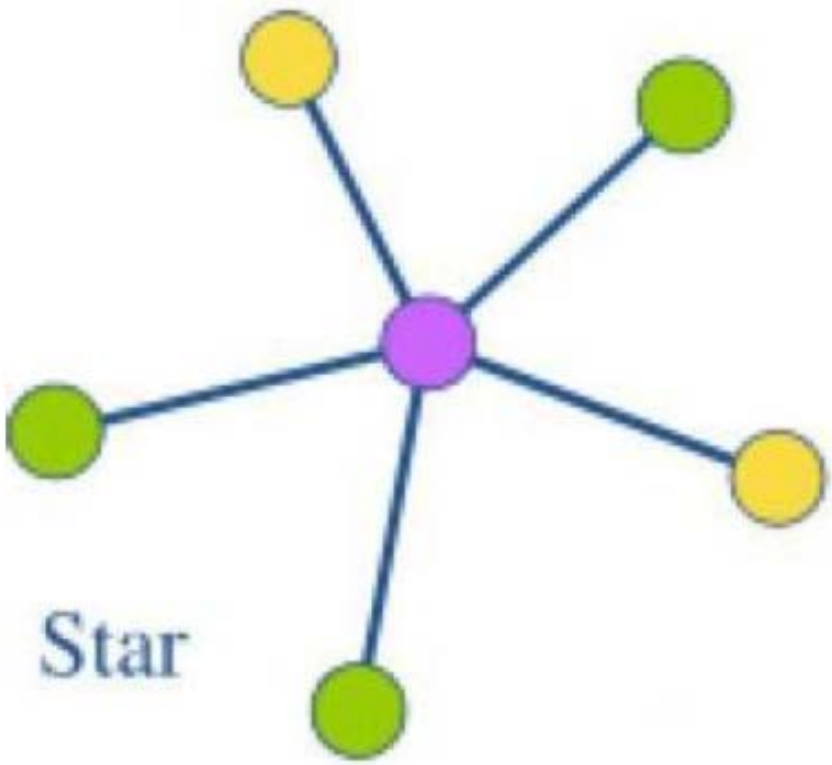
- **Three types:**

- **1. ZigBee Coordinator : serves as the root of the network tree and bridge to other networks - store information about the network and communicate with ZigBee Routers**

- **2. ZigBee Router : transmit data between different devices, e.g. from ZigBee coordinator to Router, to End Device**

- **3. ZigBee End Device : contains just enough functionality to talk to the parent node.**

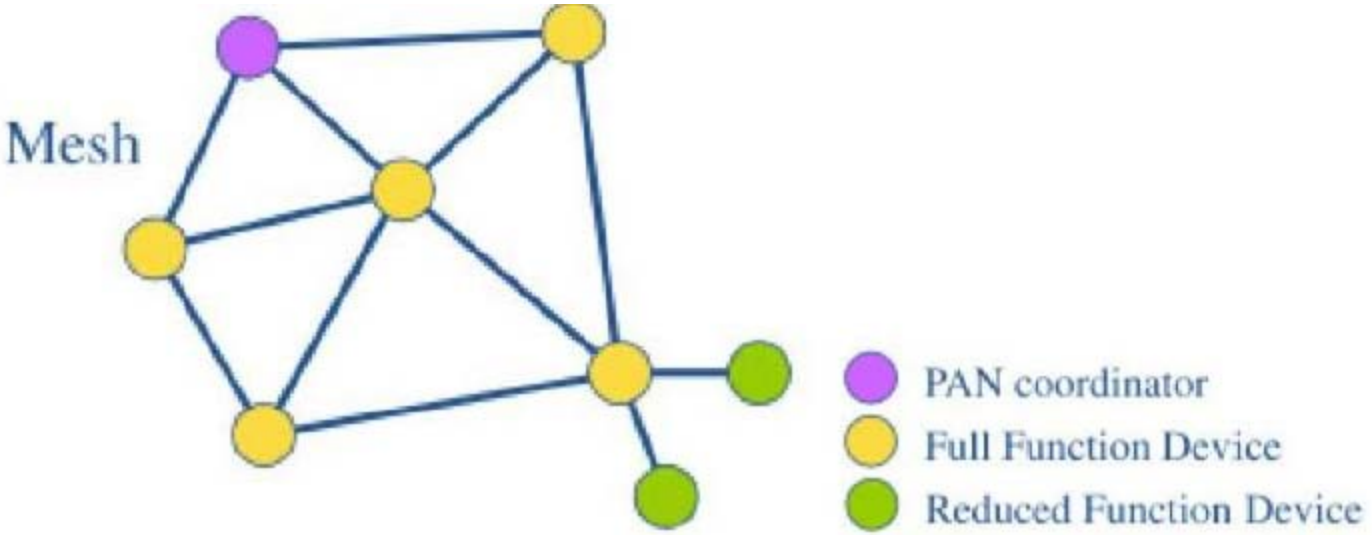
Zigbee device coverage



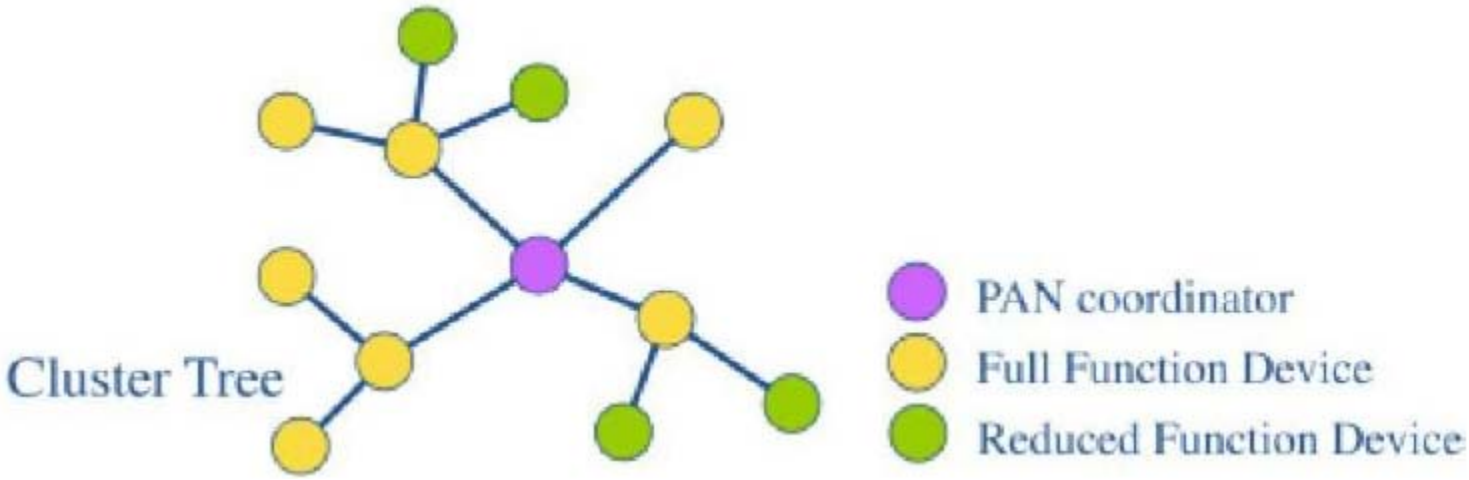
PAN coordinator
Full Function Device
Reduced Function Device

Full Function Device – routers
Reduced Function Device –end devices

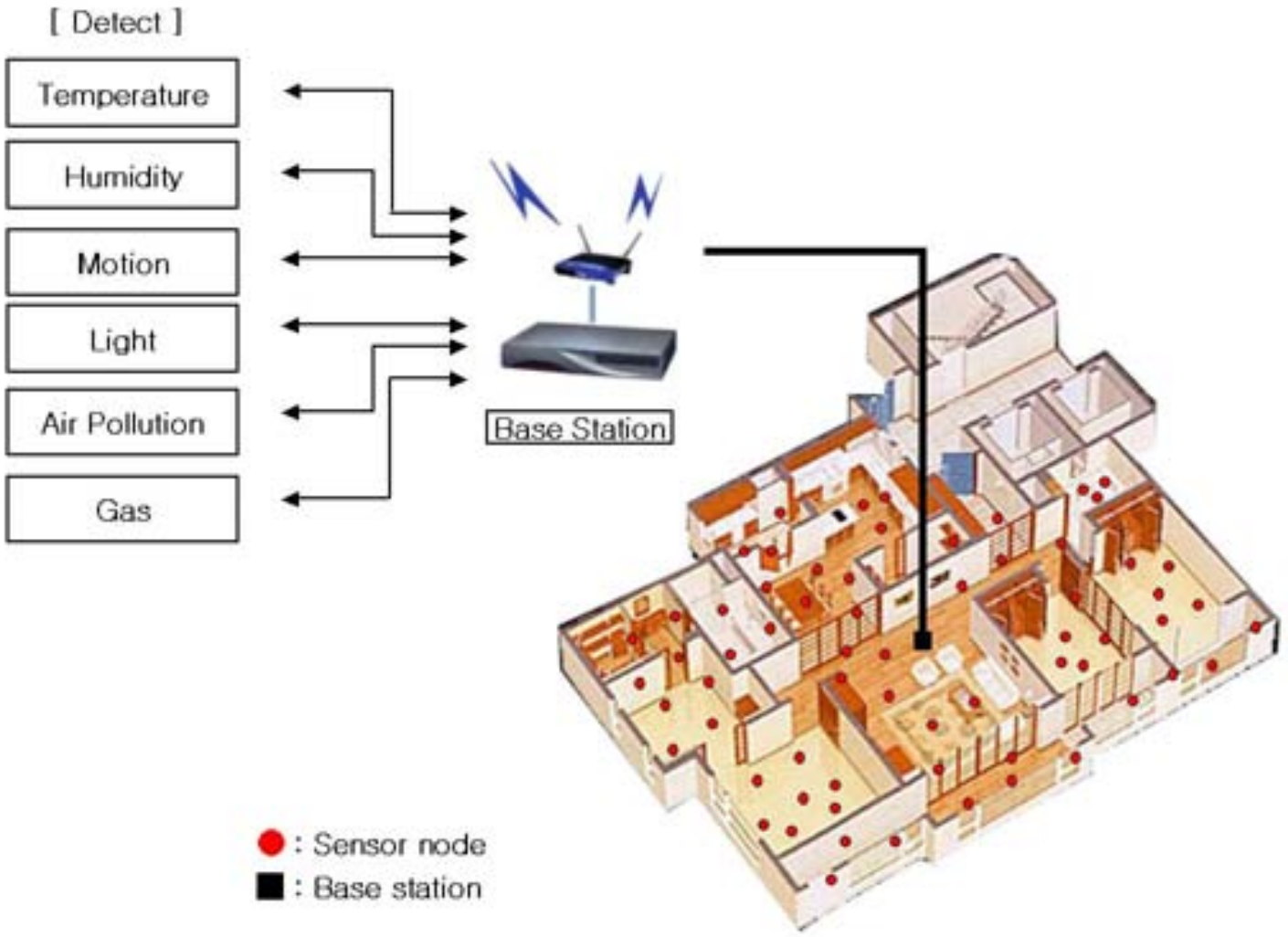
Network Topologies : Mesh Network



Cluster Tree Structure



Home Automation Network System



Home Automation Network System

- **Base Station: collects data from sensors/devices and serves as the hub to control the home automation system**

Home Automation Network System

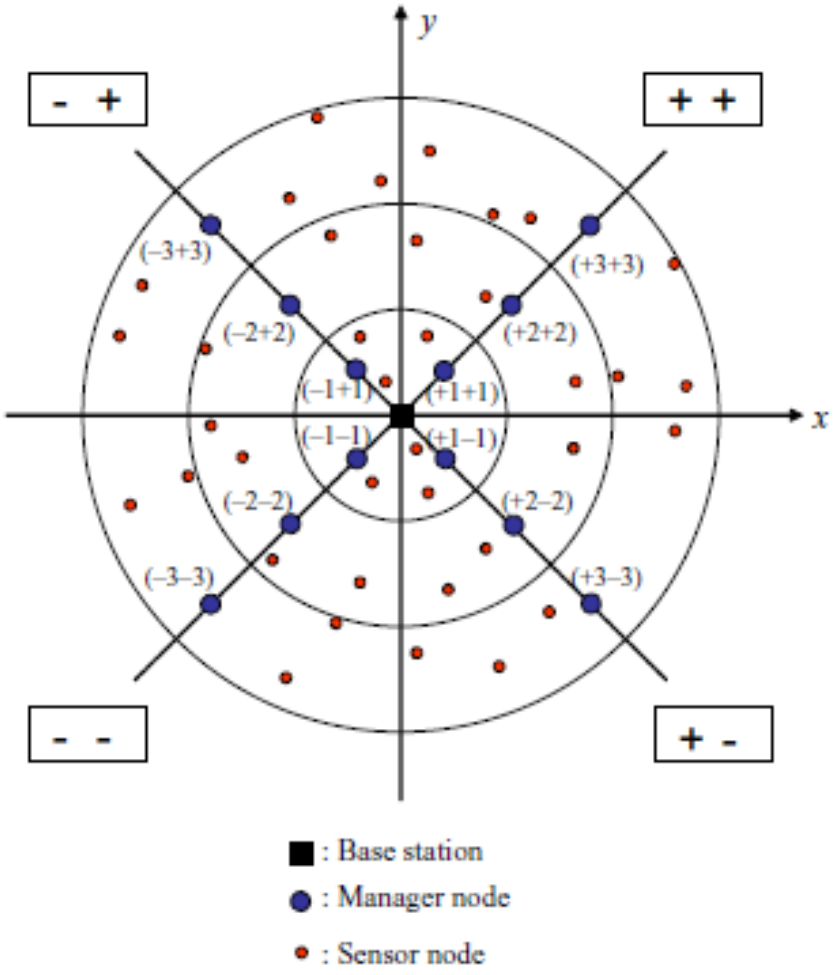
- sensors are scattered into in the house and collect data such as temperature, humidity, and light
- Appropriate devices are then automatically activated
-
- Ventilator activated when the air is foul; heating system activated according to the weather and the behavior of people in the house

Home Automation Network System

- The manager node receives collected data from sensors and delivers the data to the base station through the shortest path

- Sensors have limited battery power - so must be energy-efficient

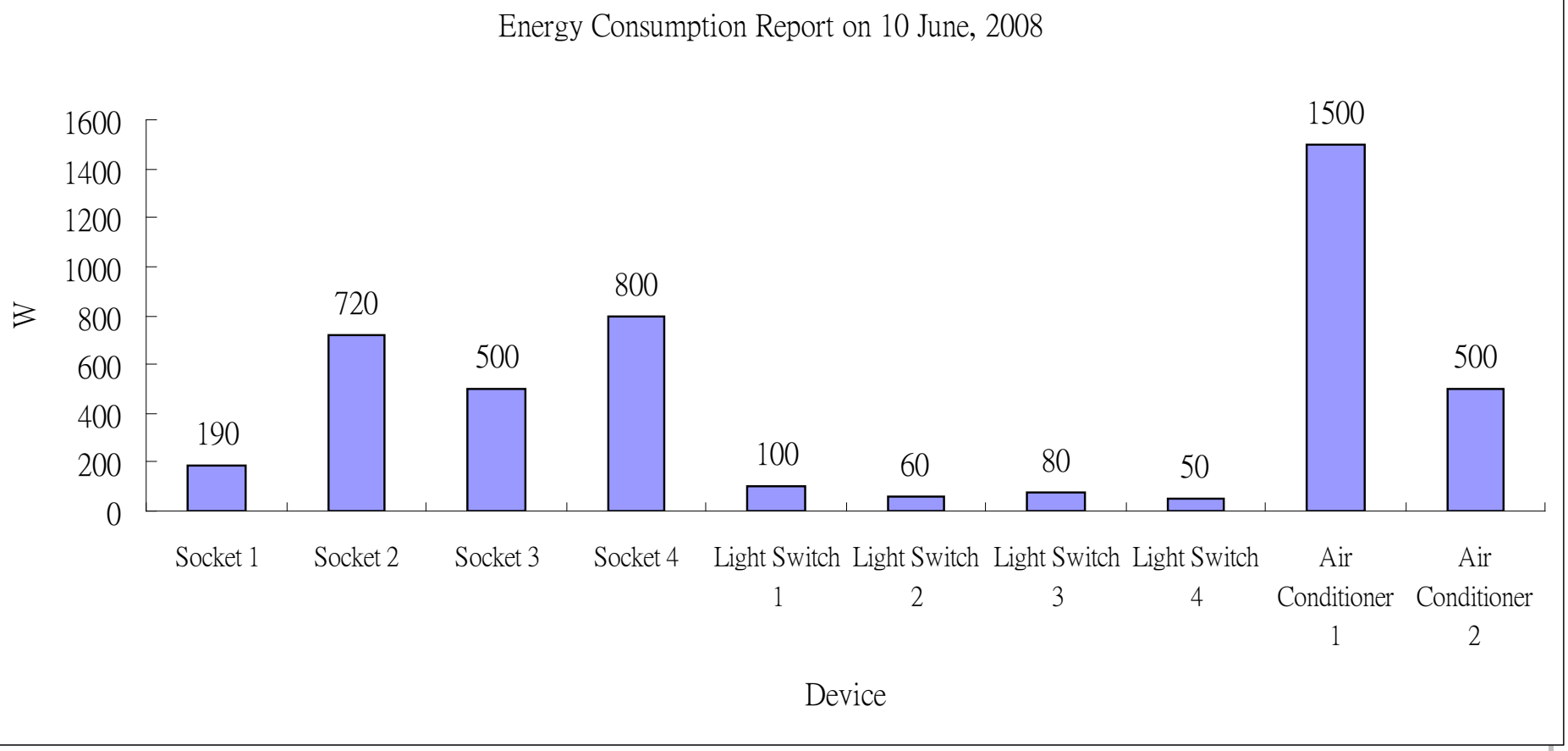
Home Automation Network System



Former work for sharing

- **Former work for sharing: examples**

Usage Time Tracking



By tracking the energy consumption, user monitors the usage time of each appliance.

Analysis

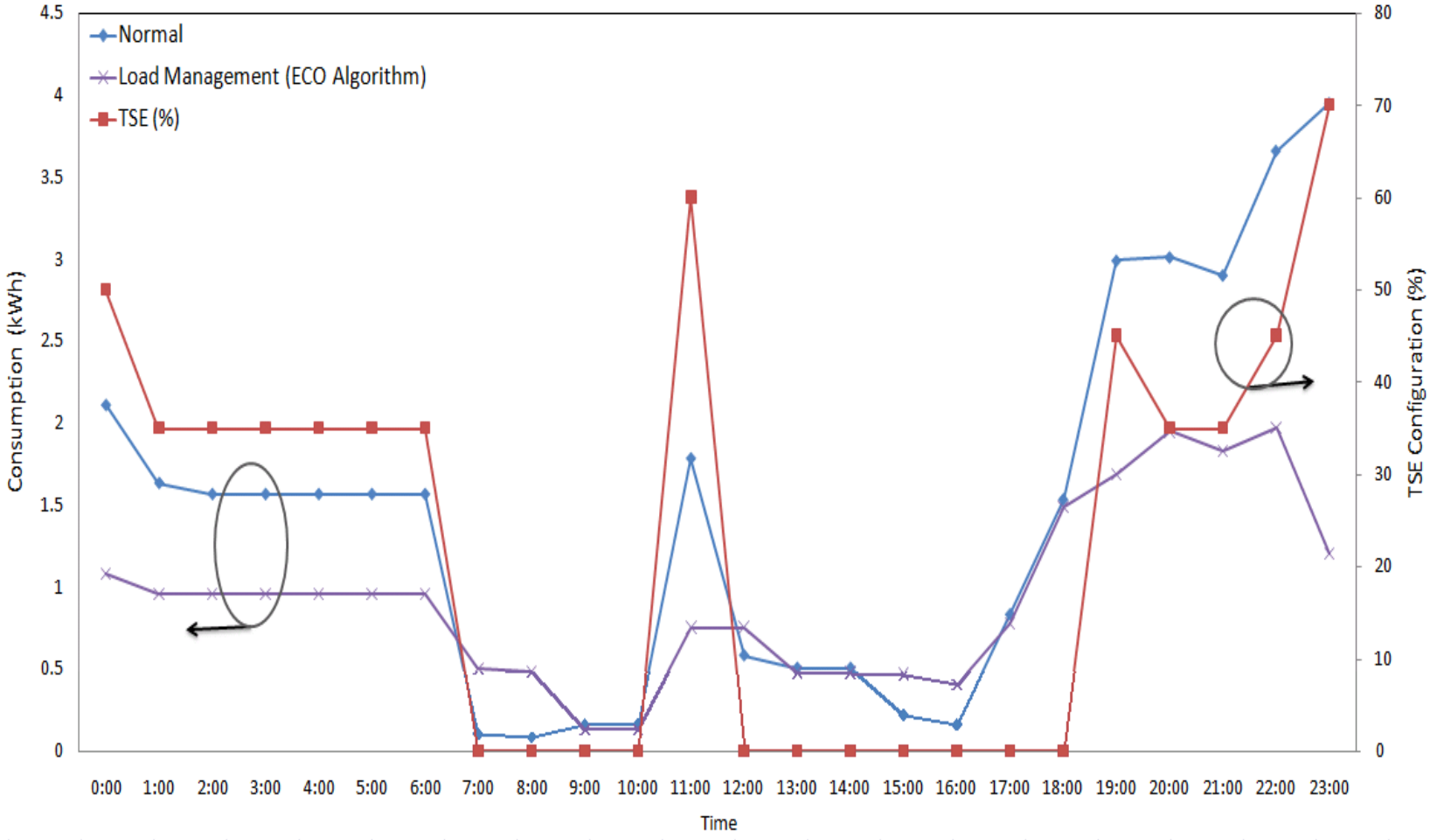


Figure 7: Load profiling study with energy management

Analysis

- Energy management system reshapes the load profile by relocating the energy demand
- Energy management system saves up 35% of energy consumption

Conclusion

- Energy management is effective for demand response
- Automation system with energy management facilities green living

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Thank You !

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