



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

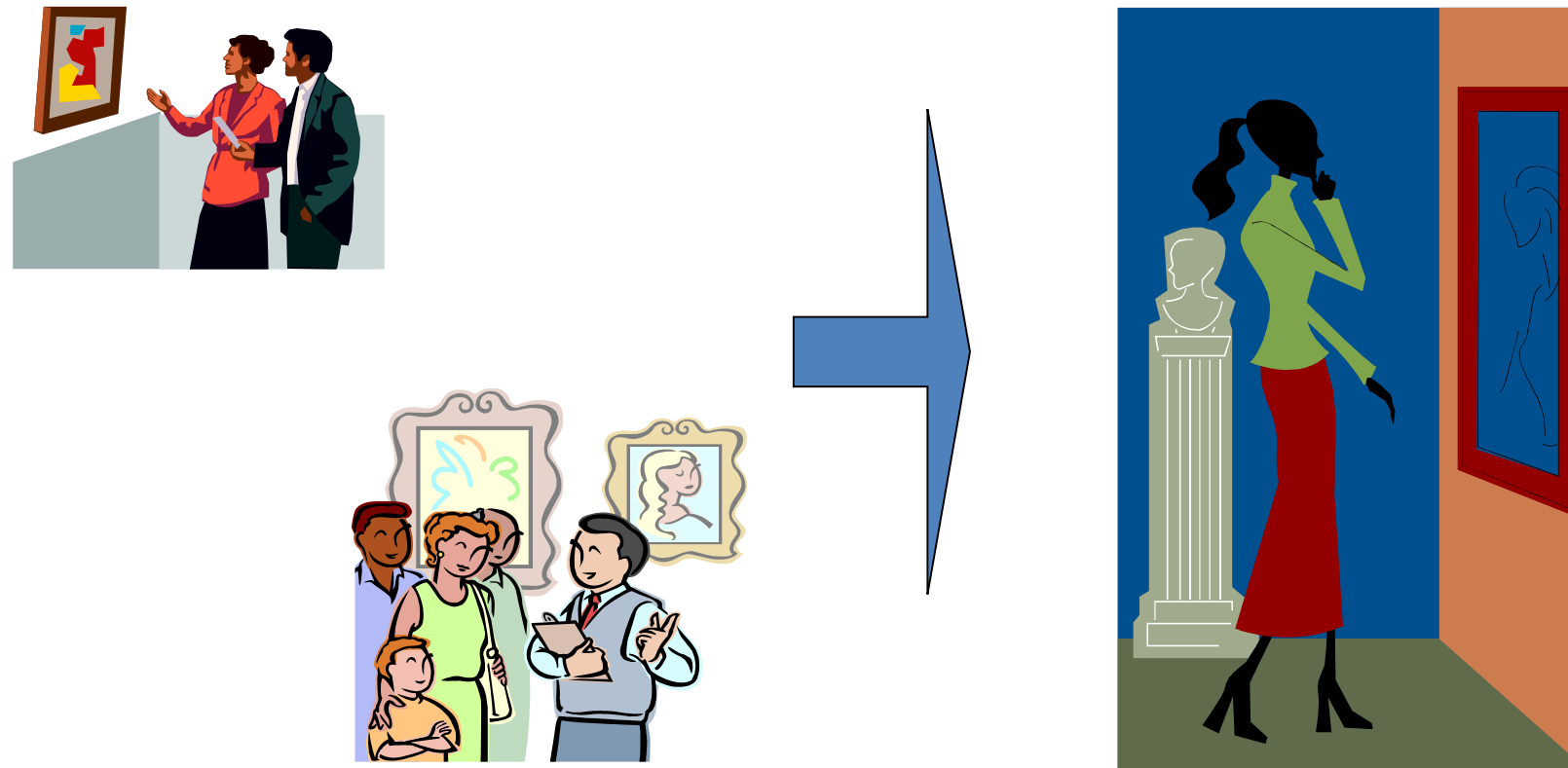
III YEAR/ VI SEMESTER
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UNIT 2 :DEVICES AND EMERGING BUS STANDARDS

TOPIC – 2.8 Bluetooth



BLUETOOTH & ZIGBEE





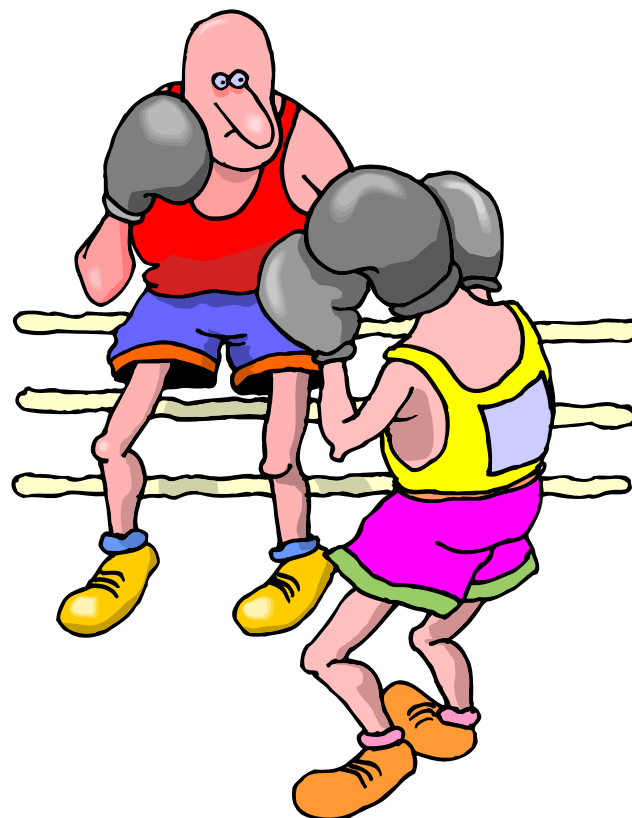
COMPARISON WITH PEER TECHNOLOGIES!

Feature(s)	IEEE 802.11b	Bluetooth	ZigBee
Power Profile	Hours	Days	Years
Complexity	Very Complex	Complex	Simple
Nodes/ Master	32	7	64000
Latency	Enumeration upto 3 seconds	Enumeration upto 10 seconds	Enumeration 30ms
Range	100 m	10m	70m-300m
Extendability	Roaming possible	No	YES
Data Rate	11Mbps	1Mbps	250Kbps
Security	Authentication Service Set ID (SSID)	64 bit, 128 bit	128 bit AES and Application Layer user defined



ZIGBEE VS BLUETOOTH

Competition or Complementary?





Bluetooth is Best But ZigBee is Better

For :

- Ad-hoc networks between capable devices
- Handsfree audio
- Screen graphics, pictures...
- File transfer

If :

- The Network is static
- Lots of devices
- Infrequently used
- Small Data Packets





AIR INTERFACE



ZigBee

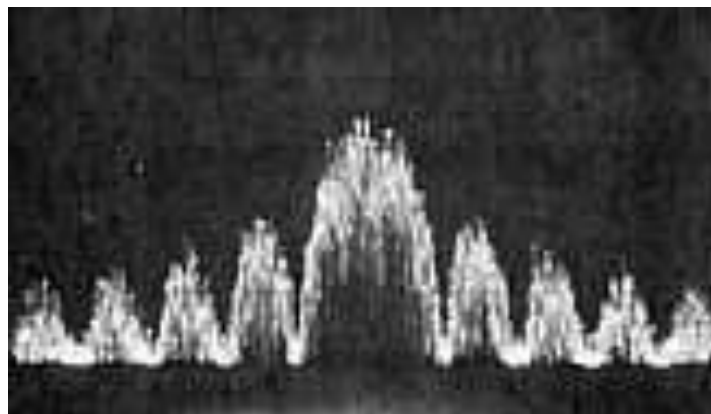
DSSS

11 chips/ symbol

62.5 K symbols/s

4 Bits/ symbol

Peak Information Rate
~128 Kbit/second



Bluetooth

FHSS

1 M Symbol / second

Peak Information Rate
~720 Kbit/second





TIMING CONSIDERATIONS



ZigBee:

- New slave enumeration = 30ms typically
- Sleeping slave changing to active = 15ms typically
- Active slave channel access time = 15ms typically

Bluetooth:

- New slave enumeration = >3s
- Sleeping slave changing to active = 3s typically
- Active slave channel access time = 2ms typically

ZigBee protocol is optimized for timing critical applications



INITIAL ENUMERATION

ZigBee

Coordinator



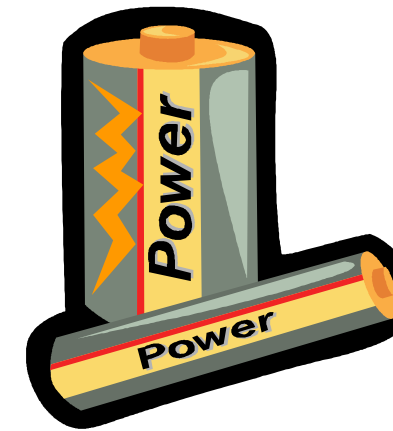
Bluetooth

Coordinator





POWER CONSIDERATIONS



ZigBee

- 2+ years from 'normal' batteries
- Designed to optimise slave power requirements

Bluetooth

- Power model as a mobile phone (regular charging)
- Designed to maximise ad-hoc functionality

Application example of a light switch with respect to latency and power consumption



SOME INTERESTING APPLICATIONS OF ZIGBEE



- Using the power of the mesh to automate a manual process
 - *Rental Car Return Automation**
- Long life battery powered sensing
 - *Wireless Termite Detection**

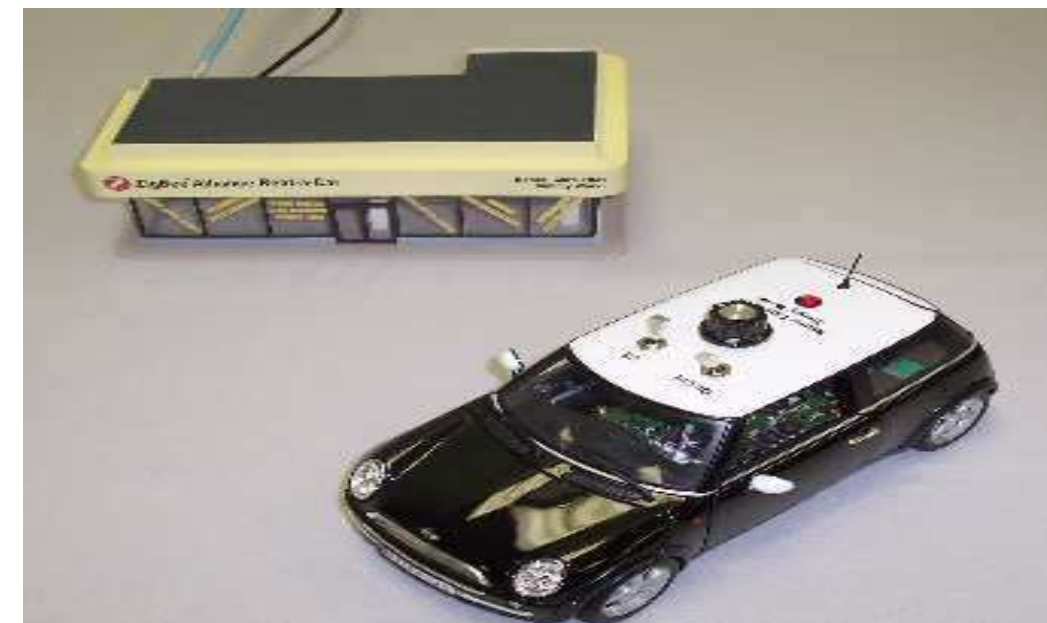
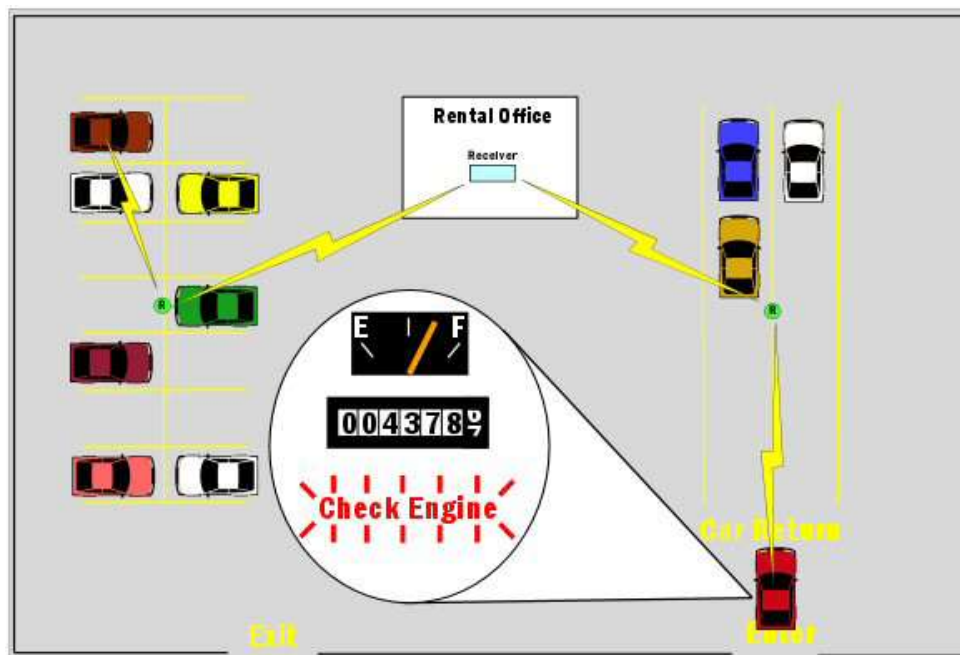
**From Software Technologies Group*



AUTOMATED RENTAL CAR RETURN*



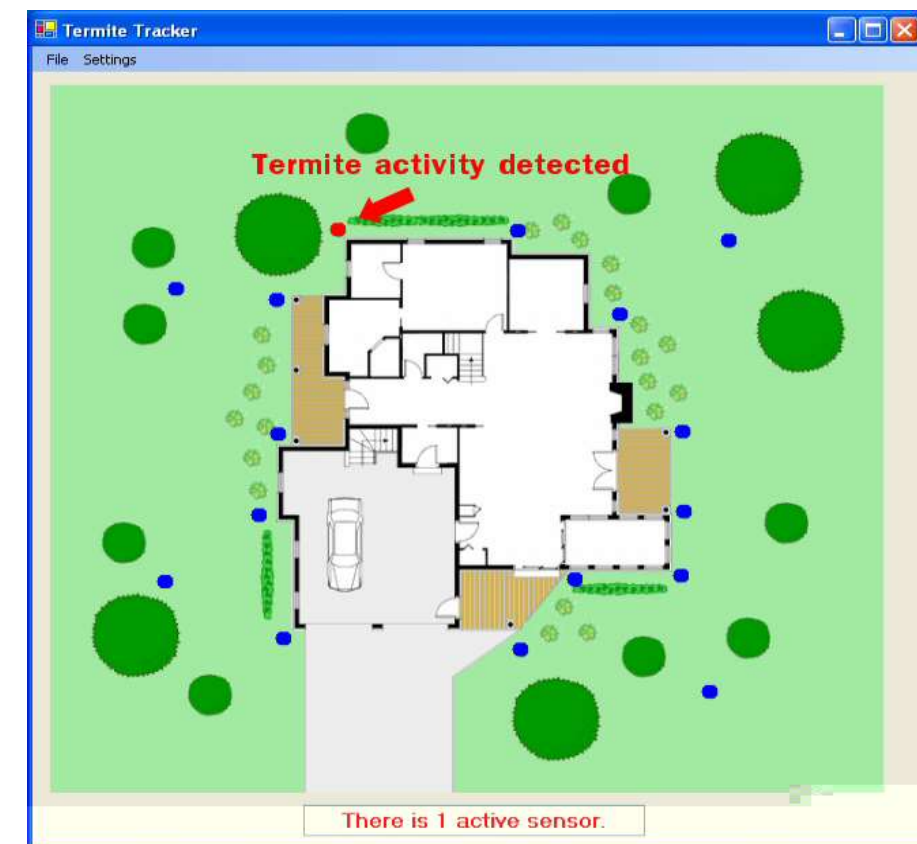
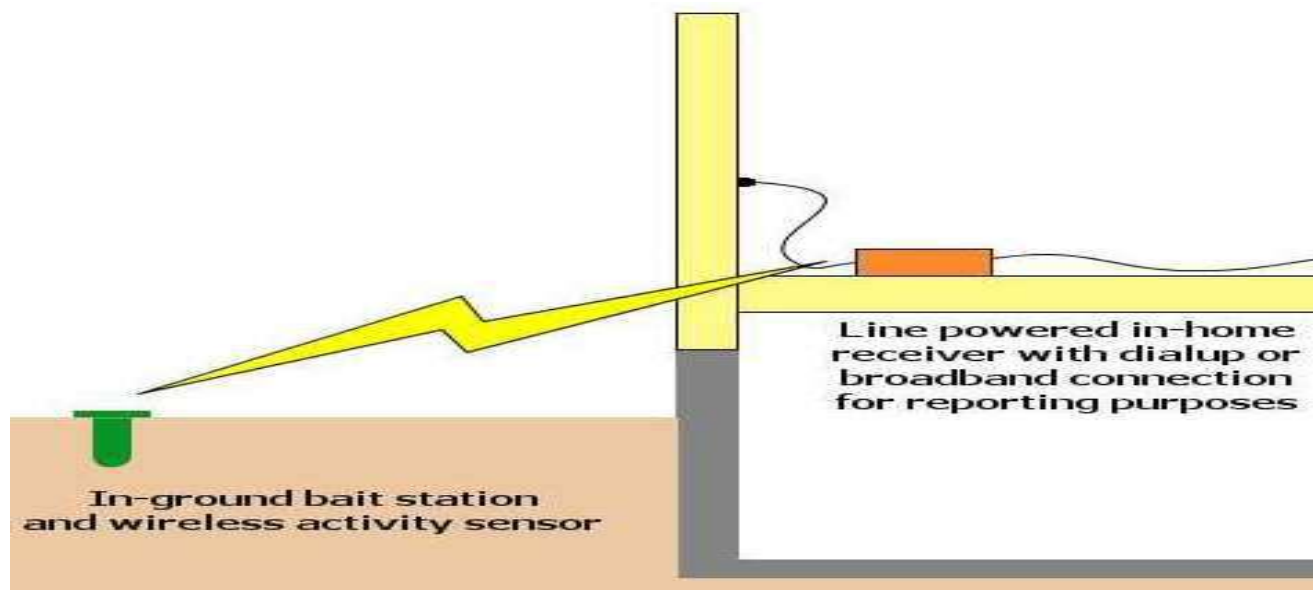
Car Rental							
File Settings							
VIN	License	Description	Odometer	Fuel	Collision	Engine	
WMWRC33412TC34910	MINI 723	2004 Mini Cooper, Black	57829	3/4	Check	Ok	
WBAEH73455B191834	7Z 2715	2005 BMW 645Ci, Metallic Blue	87410	Empty	Ok	Check	
WP0ZZZ99Z2S630474	SAB 1973	2003 Porsche 911, Silver	38579	1/2	Ok	Ok	



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TERMITE DETECTION*



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802.15.4/ZIGBEE PRODUCTS



Control4 Home Automation System

<http://www.control4.com/products/components/complete.htm>



Software, Development Kits

- AirBee, <http://www.airbeewireless.com/products.php>
- Software Technologies Group, <http://www.stg.com/wireless/>



Eaton Home HeartBeat monitoring system

www.homeheartbeat.com



Chip Sets

- Ember, <http://www.ember.com/index.html>
- ChipCon, <http://www.chipcon.com>
- Freescale, <http://www.freescale.com>

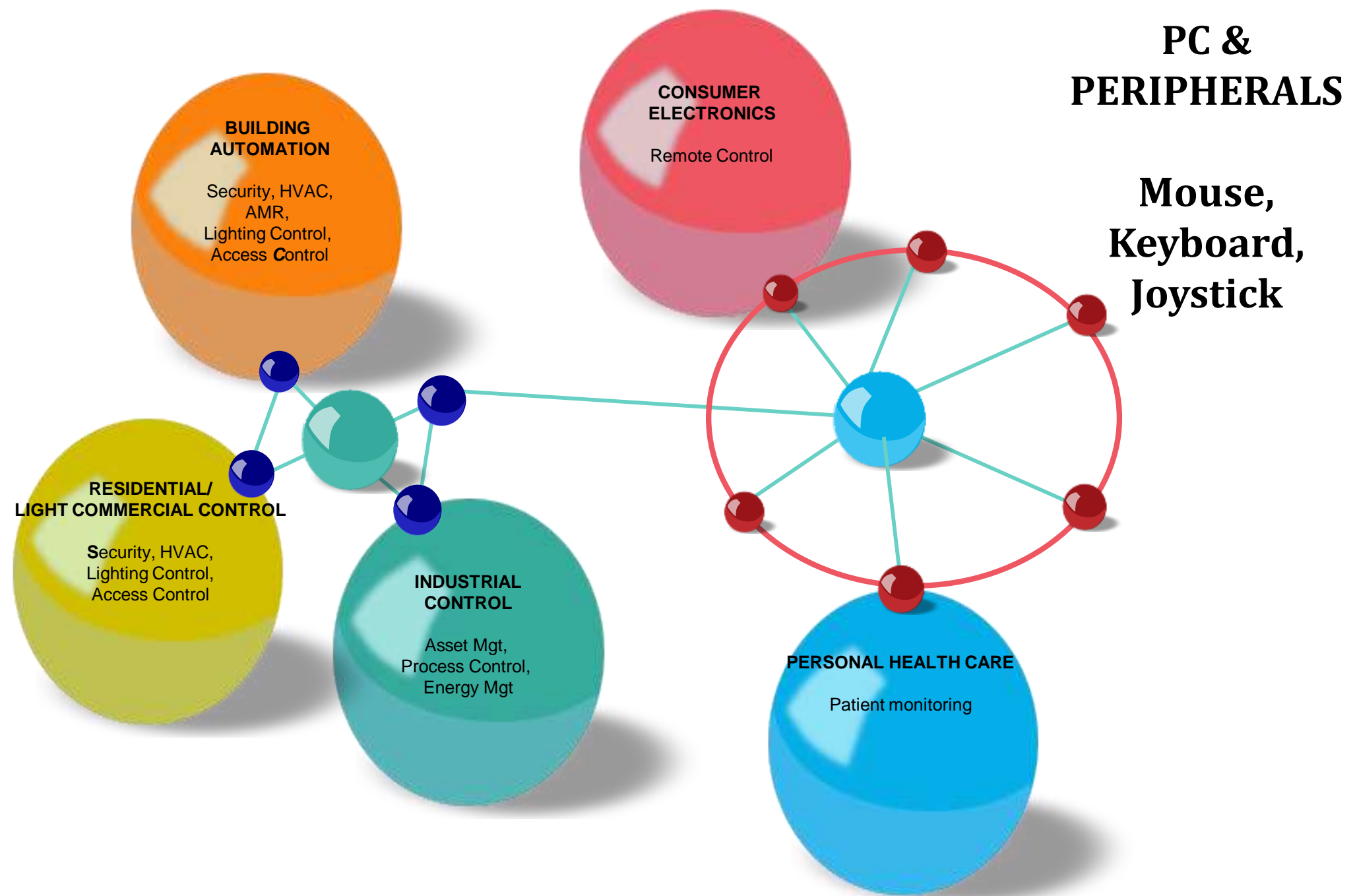


Crossbow Technology - Wireless Sensor Networks

www.xbow.com



ZIGBEE WIRELESS MARKETS AND APPLICATIONS



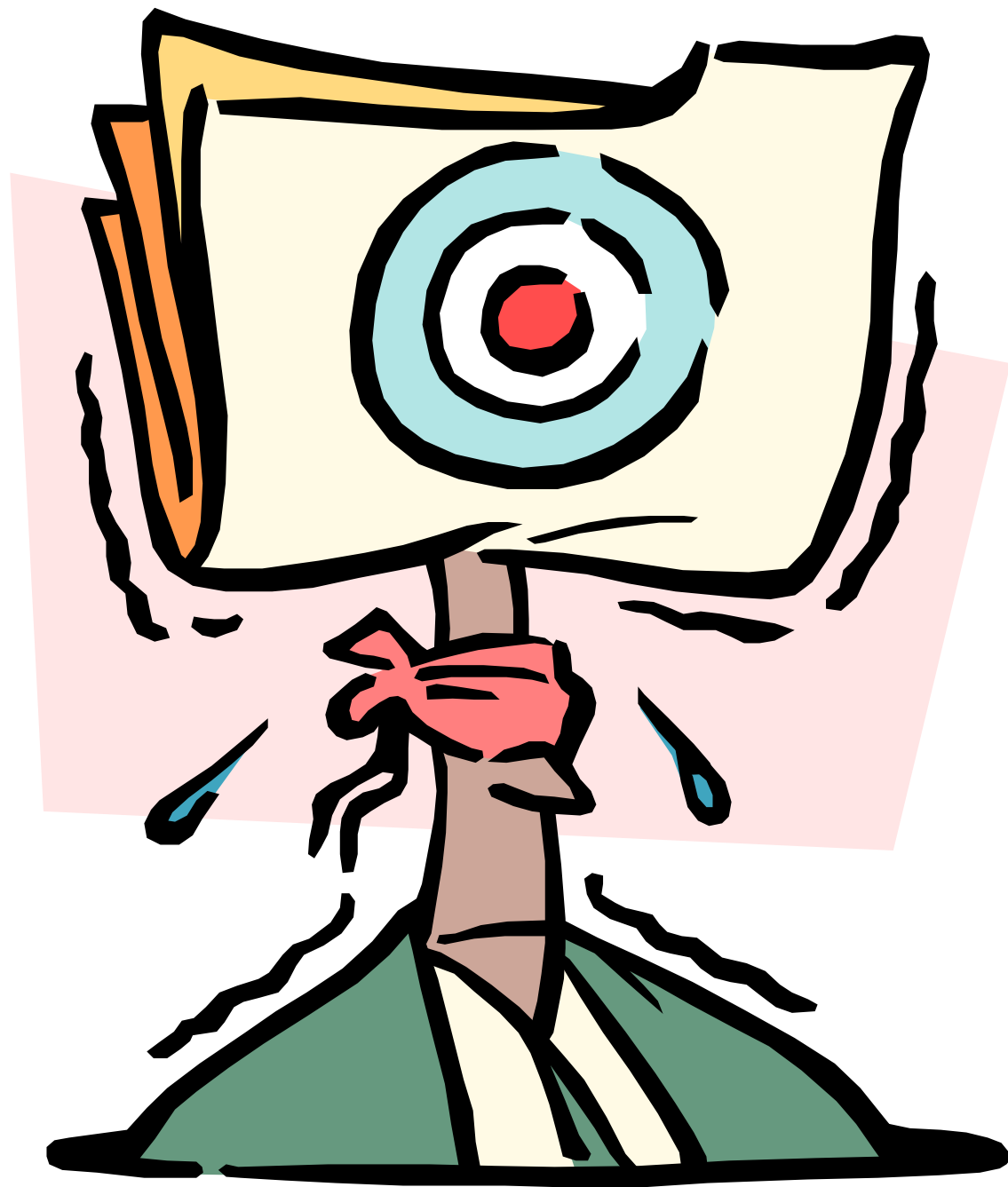


SUMMARY:

- IEEE 802.15.4 and ZigBee
 - Allows Designer to concentrate on end application
 - Silicon vendors and ZigBee Alliance take care of transceiver, RF channel and protocol, ZigBee “look and feel”
 - Reliable and robust communications
 - PHY and MAC outperform all known non-standards-based products currently available
 - Flexible network architectures
 - Very long primary battery life (months to years to decades)
 - Low system complexity. (Due to its architecture)



**Any Questions /
Thank you**



Shoot!