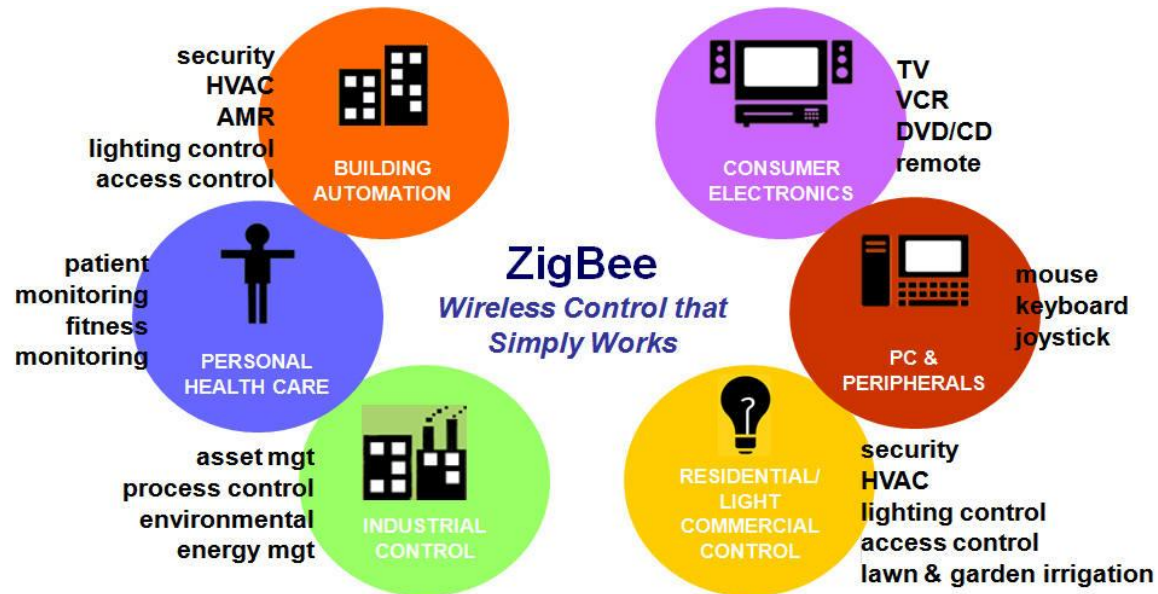


# Remote-Controllable and Energy-Saving Room Architecture based on ZigBee Communication

Authors:

Jinsoo Han, Haeryong Lee, Kwang-Roh Park

Presented By:  
Cory Engel



# What is ZigBee

Protocol developed by the ZigBee Alliance and their members

Designed for lost cost, low power wireless networks

ZigBee protocol features include:

- 802.15.4
- 250 kbps data rate
- Low duty cycle
- Low latency
- 128-bit AES encryption for secure data connections



# ZigBee Continued

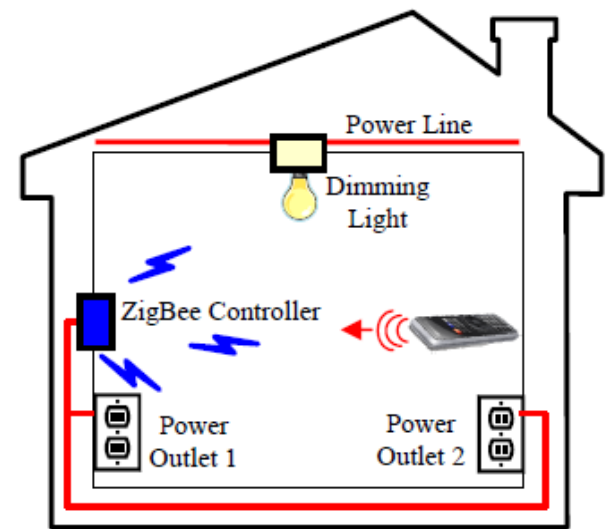
## Other Features:

- Support for multiple network topologies
  - point-to-point
  - point-to-multipoint
  - mesh networks
- Collision avoidance, retries and acknowledgements
- Supports up to 65,000 nodes



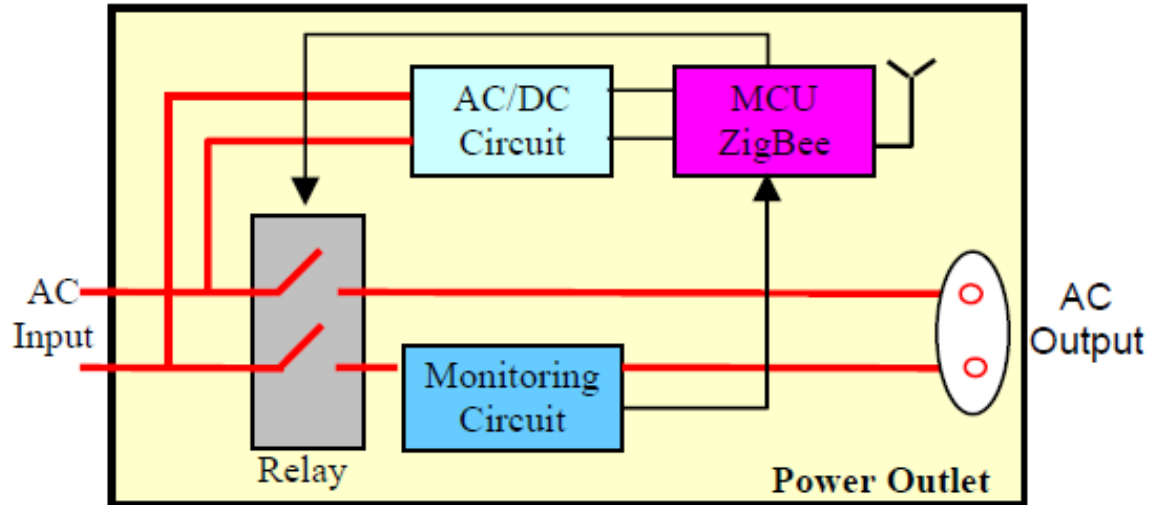
# Purpose

- Reduce power consumption in homes
- Found that 10% of household power is used by appliances while in standby mode
- Use a Zigbee MCU control structure
  - Aids in home automation
- Control many different home appliances
  - Customized remote control options



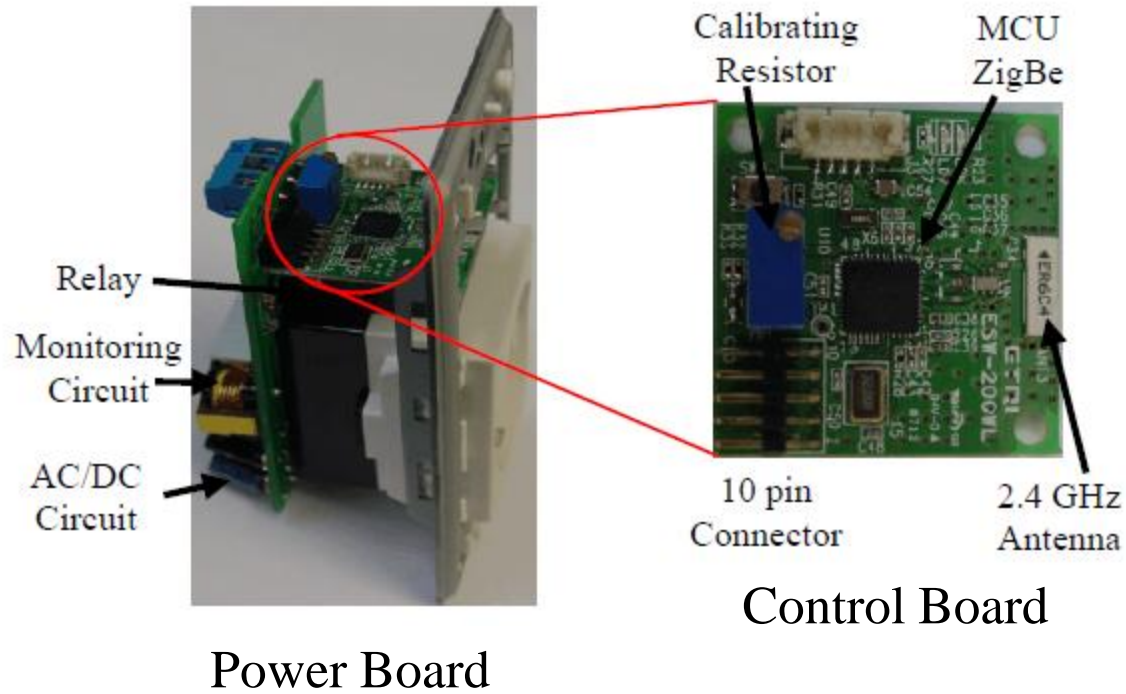
Proposed Room Architecture

# Standby Cut-Off Power Outlet



- Monitor power consumption through outlet
- Reconfigurable firmware for different appliances
- Relay is controlled by the MCU

# Actual Implement Outlet



100 ms samples

- averaged over 10 samples for 2 minutes

# State Transition Diagram

## Boot:

- Executes firmware
  - Modified for different appliances

## On:

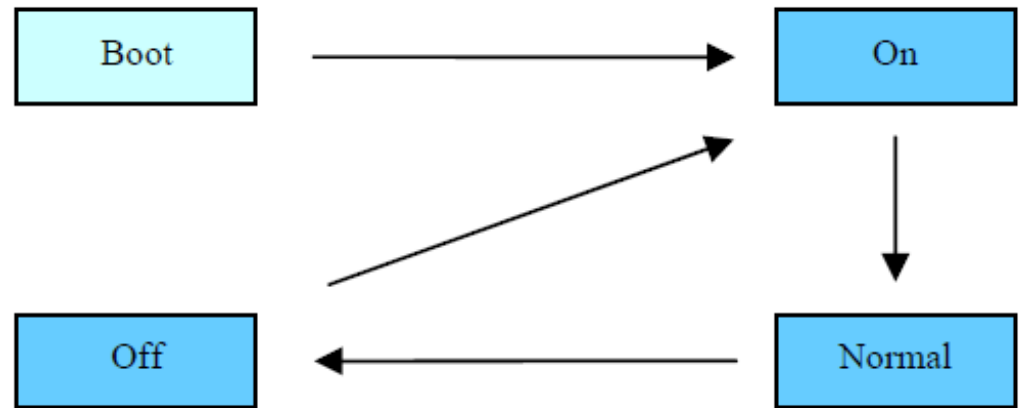
- No power monitoring
- Turns on relay
  - Allows the power to flow

## Normal:

- Monitors the power consumption
  - averaged
- Turn off relay

## Off:

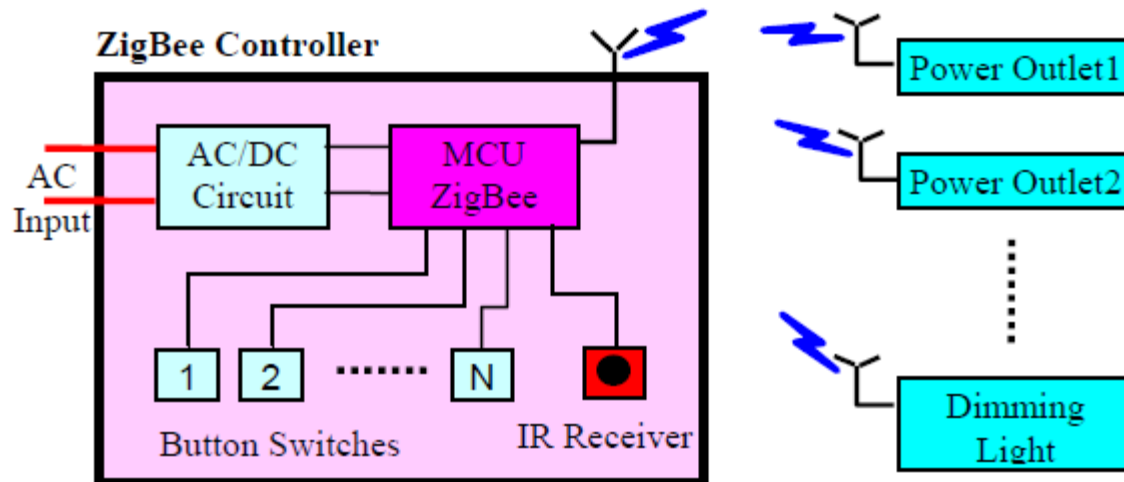
- Wait for turn-on command through ZigBee



# ZigBee Controller with IR Learning Functionality

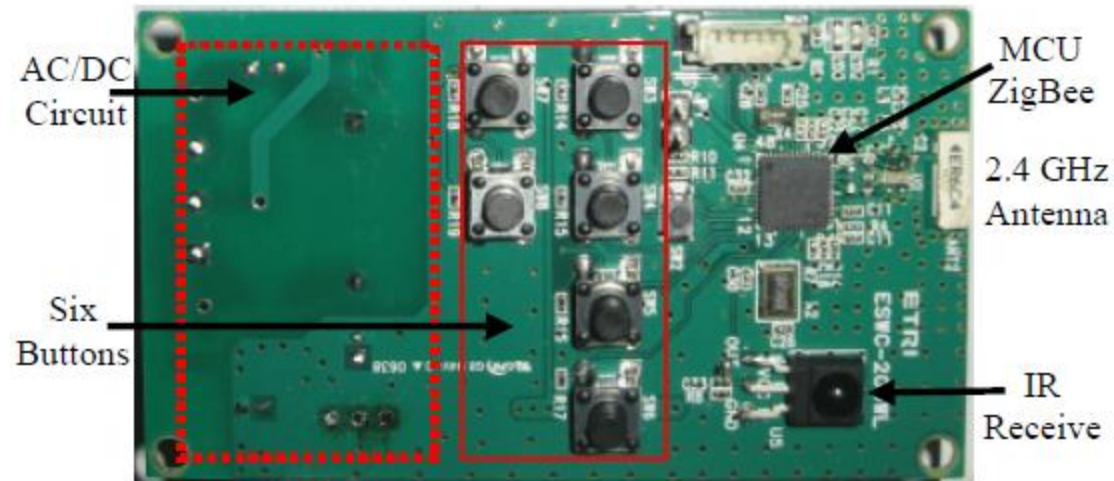
## IR Learning:

- Push and hold button
  - sdfgsdhfg
- Press twice
  - to configure button to an IR code
- IR used as recognition to send signals over ZigBee





# ZigBee Controller



Point remote at IR receive:

- Configure buttons
  - Different buttons – different commands
- Control Lights
- Can be attached to the wall
- Buttons used to wake up outlets

# Results

Tested design on a 37 in flat panel TV:

- Standby power is 550mW
- Set on firmware to 800mW
- After 2 minutes, outlet shuts off automatically
- Programmed buttons on a TV remote
- Power button
  - At TV – turns on TV
  - At ZigBee Controller – turns on outlet

Normal outlet standby = 1W

This board = 140mW

# Conclusion

## Successful implementation

- Reduced wasted standby power
- Remote controllable

## Future:

- Link together through a home server via zigbee
- All home functions from one area/remote
  - Home Automation

Possible surge protector configuration?

# References

Paper:

[http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=4814444&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs\\_all.jsp%3Farnumber%3D4814444](http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=4814444&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D4814444)

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[www.google.com](http://www.google.com) for images  
search ZigBee