

POWER PROFILE

Power consumption for a node

Global Constants

Power required to turn on mcu,sensor and to change between rx and tx of radio

$$(P_{off \rightarrow on})_{mcu}, (P_{off \rightarrow on})_{sensor}, (P_{rx \rightarrow tx})_{radio}, (P_{tx \rightarrow rx})_{radio}$$

Power in idle state for mcu,sensors and the idle and receive state for radio

$$(P_{idle})_{mcu}, (P_{idle})_{sensor}, (P_{idle})_{radio}, (P_{rx})_{radio}$$

Power for different modes and switching between them

$$(P_{on \rightarrow sleep})_{mcu}, (P_{sleep})_{mcu}, (P_{sleep \rightarrow on})_{mcu}, (P_{on \rightarrow sleep})_{radio}, (P_{sleep})_{radio}, (P_{sleep \rightarrow on})_{radio}$$

Power for processing packet, sending packet and reading sensor

$$P_{procss_packet}, P_{send_packet}, P_{read_sensor}$$

An array of total Power of the node over time and the time at which the power changes P_{total} , timex

The following modes P_{mode} have been used

- SENSE_SEND = 7
- ON = 6
- TX = 5
- RECIEVE = 4
- IDLE = 3
- SLEEP = 2
- OFF = 0

Functions/Equations

Turn On Node $(P_{on})_{node} = (P_{off \rightarrow on})_{mcu}$

Idle State $P_{idle_state} = P_{mcu_state} + P_{radio_state} + P_{sensor_state}$

MCU $P_{mcu_state} = (P_{idle})_{mcu}$

Radio $P_{radio_state} = RX * (P_{rx})_{radio} + (1 - RX) * (P_{idle})_{radio}$

RX = Whether Radio in Recieve state or idle state

Sleep Node $P_{sleep} = P_{mcu_state} + P_{radio_state} + P_{sensor_state}$

MCU $P_{mcu_state} = (P_{on \rightarrow sleep})_{mcu}$

Radio $P_{radio_state} = (P_{on \rightarrow sleep})_{radio}$

Sensor $P_{sensor_state} = 0$

Wakeup Node $P_{wakeup} = P_{mcu_state} + P_{radio_state} + P_{sensor_state}$

MCU $P_{mcu_state} = (P_{sleep \rightarrow on})_{mcu}$

Radio $P_{radio_state} = (P_{sleep \rightarrow on})_{radio}$

Sensor $P_{sensor_state} = 0$

Sense Send Message $P_{message} = P_{mcu_state} + P_{radio_state} + P_{sensor_state}$

MCU $P_{mcu_state} = P_{procss_packet}$

Radio $P_{radio_state} = P_{send_packet}$

Sensor $P_{sensor_state} = (P_{off \rightarrow on})_{sensor} + P_{read_sensor}$

Switch TX RX $P_{switch} = \text{MODE} * (P_{tx \rightarrow rx})_{radio} + (1 - \text{MODE}) * (P_{rx \rightarrow tx})_{radio}$

$\text{MODE} = 0(RX \rightarrow TX)/1(TX \rightarrow RX)$

Update Power $P_{total_{i+1}} = P_{total_i} + P_{consumed}$

Power Profile from Node

- Turn on node without radio
- Init/Leds testing
- While Loop
 - Turn radio on
 - CCA
 - Send Message(3Bytes*100packets)
 - Turn off
 - CCA

