18748 – Wireless Sensor Networks – Spring 2016

Carnegie Mellon University

Lab Assignment 2 (100 points)

Due: 13th February 2017, 11:59pm EST

Whack – A – Mole

What's the objective?

Whack some moles... Sensor-network Style

What's the playing field?

Your playing field consists of:

- 3 Moles–Firefly nodes w/LEDs & Light Sensor(Slaves)
- 1 Master-Firefly node connected to a PC

What's the Game?

Each sleepy mole, has its own sensor node
When it gets bored, it pops from the hole
You gain points, by whacking the mole
To keep them asleep is your real goal
Faster you are, the more you score

What does the Firefly have to do with all this? (50 points)

- Use the **RED** LED to show that a mole has popped up
- Use the LIGHT sensor to detect that it's being whacked (you can either design your system to treat an increase in light, e.g. shining a light on it or decrease in light, i.e. covering the node as an indication of the node being whacked)

How to play it fair?

1. Game starts only when the player is ready (Ready-set-go) **(10 points)**
   a. Master (connected to the PC) waits for a key press
2. Only **one** node should be on at any time (important invariant) **(10 points)**
3. Same mole should not pop back-to-back (time-to-heal?) **(10 points)**
4. Score should be updated continuously (Motivation) **(15 points)**
   a. The total-time-to-whack is the current score

5. Game ends in 10 rounds (Humans have low battery life) **(5 points)**

Any game plans?

1. As with any team work, the master node acts as the leader
2. Master determines the next mole to wake up from its hole
3. Master instructs the chosen mole to pop up (LED lights up)
4. Continuously poll the sensor node to check its status
5. Go back to step 1 when the mole gets whacked and count<10

(This is just a suggestion… Do whatever it takes to satisfy the goals)

Cheat codes…Anyone?

- Check out the skeleton code by updating your repository.
    1. cd <your_repo>
    2. svn update
    3. cd <your_repo>/projects/lab2 and you will find the skeleton code
- What does the skeleton code do?
    - B-MAC description: http://www.nanork.org/projects/nanork/wiki/b-mac
    - B-MAC APIs: http://www.nanork.org/projects/nanork/wiki/bmac-api
    - Master polls slave nodes periodically asking for light values
    - Slave nodes reply to the master polling message

Gotchas

Wireless channel suffers from packet loss

- If you ask a mole to pop up and the packet gets dropped
    - Don't get mad at the mole, re-transmit the command
- If you poll the mole for a status and it does not respond
    - Resend the command, don't worry about its health

For a refresher course…visit

http://www.nanork.org/projects/nanork/wiki/Tips-and-Tricks

Are you Game for More? (Extra Credits)

- Timeouts **(3 points)**
    - Moles should time-out and jump to another board
    - Add a penalty for not whacking-on-time
- Interesting game play **(4 points)**
    - Start slowly and push the player to his limits
        - i.e. reduce the timeouts as the game progresses
    - Record the highest scores
    - Use fake LED lights
        - LEDs **except** RED can be randomly turned on.
- Global light change **(3 points)**
    - Adaptive design to accommodate global light change
- Self-Healing **(5 points)**
    - Detect a dead slave node (told you not to whack hard...)

        - Handle the TA turning off one of the slave nodes
    - Reconfigure the game on-the-fly

Enough of this stuff… Get me my grades

- Check-in your code by "svn commit".
    - Place your code in <repo>/projects/lab2.
    - Remember to comment your code and add
        - Names of your team-members
        - Team Number
- Turn-in a 1 page write-up describing your architecture
    - What are the cool things that you do?
    - You should submit your write-up in <repo>/projects/lab2 (don't forget to svn add!)
    - Estimate the following:
        - System-Latency
            - Worst case time for a mole to wake up
        - Estimated life-time when powered by batteries
- Give a demo of your implementation to the TA

References: (If you still don't get it….)

http://en.wikipedia.org/wiki/Whac-A-Mole

Questions and Answers: Please use the discussion forum on Pizza.