IN11A-0102: Turtle Nest Monitoring with Wireless Sensor Networks

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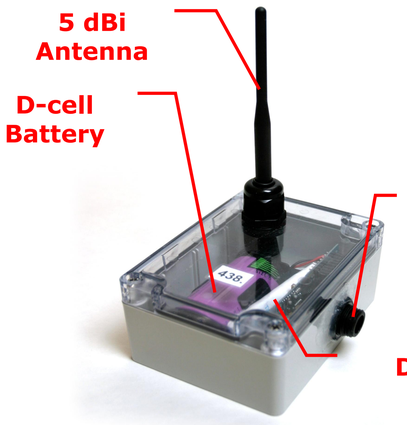
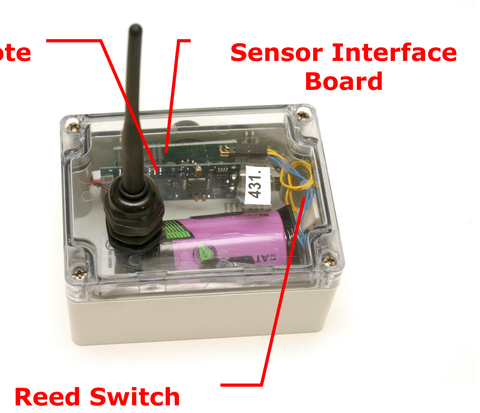
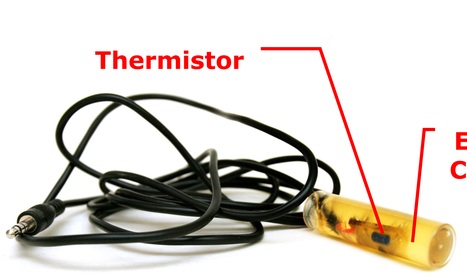
Hardware / Software

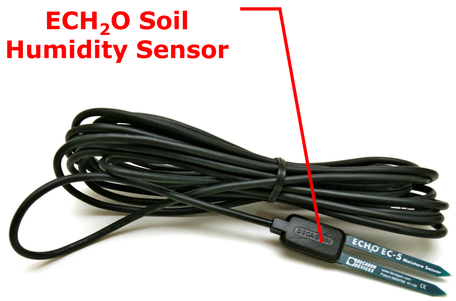
Design goals: ***lower power consumption***, ***better water-proof strategy, higher scalability*** and ***higher reliability***.

We use the Tmote Sky platform for its low-power consumption and reliability. We have designed our own 4-channel analog interface board with its own stabilized reference voltage. The sensor interface board, the mote USB port and the reset button can be accessed without opening the enclosure. To connect patches of sensors over long distances, we are experimenting with long-range (several miles) 900 MHz and high-power 2.4 GHz radio transmitters.









Koala is our software platform designed for a duty cycle as low as 0.1%. Features include *Low Power Probing* (LPP) and *Flexible Control Protocol* (FCP); protocols we developed for waking up a network and end-to-end data transfer respectively. Before downloading data, the base station wakes up the network with LPP and gathers neighborhood link connectivity information from each mote. Then, it downloads data using multi-hop paths derived from the link connectivity information.

We are currently preparing and building a network of 200 motes and more than 1000 sensors!

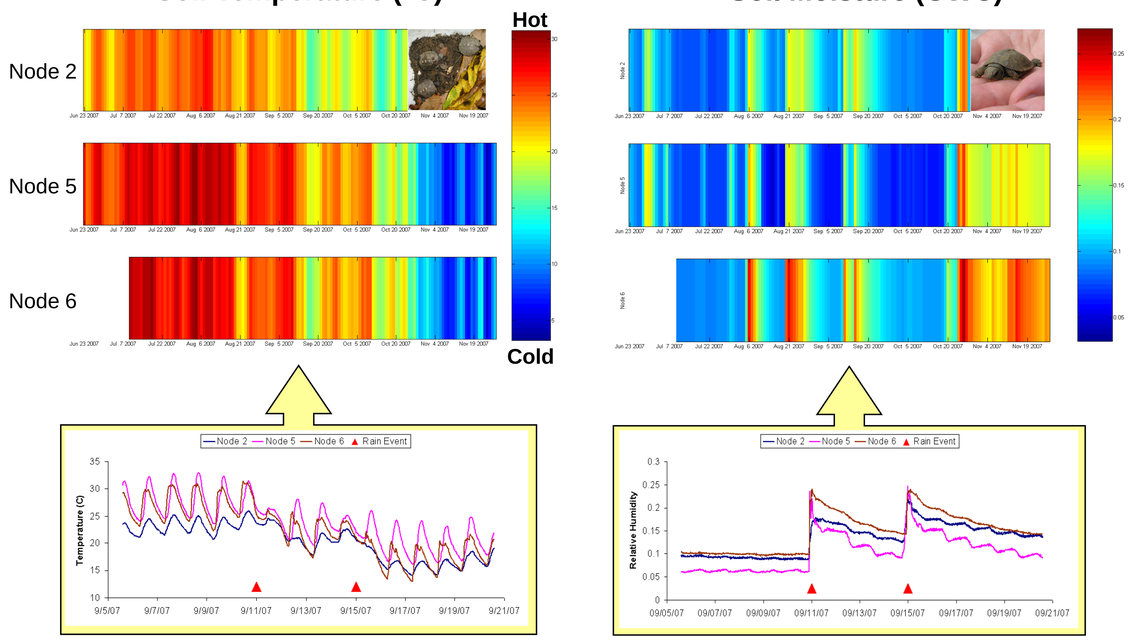
Deployment Data

Box Turtles, like other turtles, lay eggs in the soil where solar radiation provides the heat for incubation. More unusual is the fact that the gender of most turtle species is not determined by the sex chromosomes, but instead by the temperature at which the embryos develop. In the case of Box Turtles, male hatchlings develop when incubation temperatures are 27-28 °C; whereas females develop at 29-30 °C.

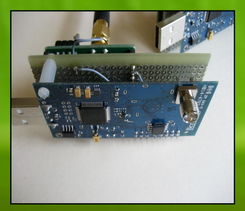
Global warming has the potential of raising the summer soil temperatures where turtles nest, and it potentially leads to a bias in hatchling sex.

At our study site in Maryland, we work with a population of 530 individually marked turtles. In this summer, we monitored the soil conditions around three nests representing three different microhabitats.

- Node 2: At the edge of the forest.
- Node 5: On an open grassland.
- Node 6: Near the parking lot.



This is the first study to demonstrate Box Turtle nesting conditions in situ. Sensors showed considerable differences in the soil abiotic conditions among the three nests. We expect that the remaining two nests will hatch in spring 2008.





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