

A Wireless Water Level Control System

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Introduction: Using motes as a tool to retrieve pertinent data from its environment

Wireless Voltmeter

- The mote extracts data from an unknown voltage source through a sensor board directly connected to the mote. (see Fig. 1)
- The mote sends a packet with the extracted data to another mote through the radio. (see Fig. 1)
- Under the *listen* command, the second mote receives the data and passes the data to the PC. (see Fig. 2)
- The PC translates the data into a readable voltage value. (see Fig. 2)

Takes continuous reading

Water Level Control System

- The "Demand mote" constantly checks the tank's water level status. (see Fig. 3)
- If the water level is too low, the "Demand mote" asks the "Supply mote" to turn on the water pump. (see Fig. 4)
- Once the water level is stable, the "Demand mote" tells the "Supply mote" to turn off the pump. (see Fig. 5)
- Throughout the entire process, the "Status mote" monitors the water level and pump status (on/off) and displays it on the computer screen. (see Fig. 6)

Note: There is actually just one "Supply mote."

Problem Description: Extending the capabilities of a mote such that it can perform this task

Summary

- Normally, a mote programmed with `Chirp` reads data from the serial port and sends the data packet over to another mote programmed with `GenericBase`. After receiving the packet, the other mote passes the data to the PC, causing the raw data to display on the screen. But who wants to deal with raw data?

Questions

- Wireless Voltmeter
 - How would a mote read data from an unknown voltage source?
 - How would a mote read analog data?
 - How would it send the information? How would it interpret the information?
 - How accurate are these voltage values?
- Water Level Control System
 - How would the "Status mote" determine the water level and pump status?
 - How would the mote monitor the status?
 - How would the "Supply mote" turn the pump on and off?

Proposed Solution: Program motes that enables it to read, send, and use data as needed

Wireless Voltmeter

- Concept:
 - The data read from an unknown voltage source (in this case, a battery) is in analog format but the computer can only process data in digital format.
 - Connecting the terminals of the unknown voltage source to an ADC (Analog to Digital Converter) port allows a mote to convert the analog data to digital data.
 - Once the data is in digital format, the computer can read, send, and use the data as needed.
- Procedure:
 - How to extract data from an unknown voltage source
 - In any instrument that measures voltage, the measuring probes must be placed between the terminals of the unknown voltage source.
 - Sensor boards do not have measuring probes, but they do have an ADC serial port and a ground serial port that serves the same purpose as the red and black probes of a standard voltmeter.
 - A mote converts the analog data into digital data through its ADC converter then sends a data packet to another mote.
 - The other mote receives a packet and extracts only the voltage bytes.
 - It then calculates the voltage reference (for accuracy) and uses that calculation to determine the input voltage.
 - After the calculation, it sends the data to the computer, which will print the information on the screen. (see Fig. 7)
 - How to evaluate the wireless voltmeter
 - Compared the values given by a standard voltmeter to the values given by the wireless voltmeter.
 - Connected terminals of a battery to a potentiometer for variant voltage. (see Fig. 8)

Water Level Control System

- Concept:
 - Theoretically, a resistor's value goes down to 0Ω when dipped under water.
 - A series of resistors connected between a voltage source's terminals could then serve as a water level sensor.
 - The voltage reading across the series of resistors depends on how many of the resistors are under water--more resistors under water means there is less voltage and vice versa.
 - The water level can be determined by the voltage value across the series of resistors.
 - Modifying the wireless voltmeter such that it includes parameters for the water level gives us the "Demand mote!"
- Procedure:
 - How the "Status mote" determines the water level and pump status
 - The "Status mote" receives the data packet (voltage reading) from the "Demand mote," and under the command *listen*, determines the water level and pump status, then prints it on the computer screen.
 - The command *listen* is modified such that it includes voltage parameters, which is used to determine the water level. When the voltage reading reaches a certain threshold, the "Status mote" will state that the water pump has been turned on or off. (see Fig. 9)
 - How the "Supply mote" turns the pump on and off
 - The "Supply mote" contains parameters that determine whether the pump should be on or off.
 - When the "Demand mote" sends a voltage reading that reaches a certain threshold, the "Supply mote" will either turn its red LED light on or off, representing the state of the pump.
 - The red LED light remains on until the water level is stable and does not turn on again until the water level is low. (see Fig. 9)