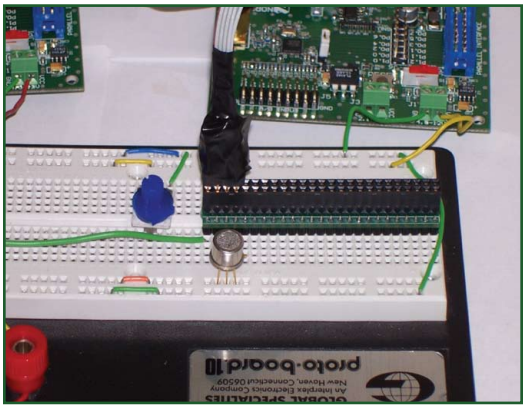
RESEARCH in Progress

Forest Products Laboratory

Integral Wall Moisture Sensing and Control

High humidity levels and moisture in the structural cavities (wall, roof, and floor) of wood buildings are major contributors to wood degradation. Moisture ingress (at window and door trim, roof flashing, and other exterior coverings) and plumbing failure are major sources of moisture problems. Correct vapor barrier placement and construction techniques are important to the prevention of moisture infiltration. However, an active method to identify sources of inevitable barrier or plumbing failure is an important addition, especially as buildings age.



Transceiver and sensor

Background

Others working in the area of moisture sensing and control have (1) shown the potential for placing sensors inside residential walls to continually monitor the "health" of the walls, (2) developed robust temperature and humidity sensors, and (3) made considerable progress on developing the IEEE 1451 standard for wireless sensors. Smart, wireless, low-cost sensors can now identify and configure themselves to the host computer in a "plug and play" fashion using the IEEE 1451 standard for a multi-sensor platform. Essential work that remains is the integration of these technologies into a single system that can detect and help correct moisture problems inside the house while remaining easy for the average homeowner to use and interpret.

Objective

The objective of this project is to design a single system that can detect and help correct moisture problems inside a structure and that offers a homeowner-friendly host communication and control system.

Approach

The basic approach to the project will be to (1) identify existing and potential sensor technologies for in-wall humidity/moisture and temperature sensing, (2) develop platforms for testing different sensor technologies, (3) characterize humidity, temperature, and moisture sensors for use in wall structures, (4) assess sensor power requirements and investigate passive systems and recharging methods, (5) assess the effectiveness of communications methods, and (6) complete preliminary design of the host communication and control system.

Wireless sensing devices will be placed in building cavities at high-risk areas in the structure. These intelligent sensing devices will be custom designed from off-the-shelf components, including transduction elements (such as humidity, moisture, temperature), wireless communication elements, and a programmable microcontroller. A control server computer will communicate with the sensors and provide user (such as reports, warnings, data), network, and actuator (such as fans, vents) interfacing and integration. Communication will be through a combination of synchronous polling (for status, watchdog, and timing functions) and asynchronous interrupts (for sensor-initiated functions).

Because transducers for active sensing require power, sensors utilizing an inductively coupled charging system will be used. This technology will recharge the batteries while the sensors remain situated within

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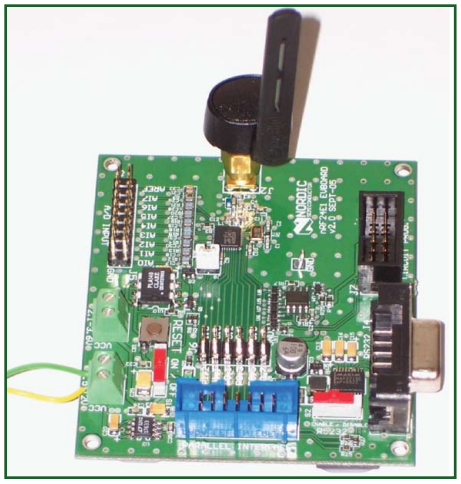

Transceiver

structural cavities. Inductive charging through coupling with existing AC household wiring will eliminate the need for user interaction.

A multisensor platform (IEEE 1451) will provide "plug and play" integration of the intelligent sensor system as sensors auto-configure, identify, and register themselves with the control server as they are placed in the environment. The sensor's integration of multisensing, communication, data recording, and programmability (customized behavior), all on a self-configuring platform, will allow researchers to focus on research objectives and make the technology attractive to builders and homeowners. The control server's networking capabilities will provide secure access for remote monitoring, for both research and end-user application.

Expected Outcomes

This project is expected to result in the design of a detection system that allows homeowners and inspectors to know when an undesirable moisture

Humidity sensor

condition is present inside walls of residential housing. This form of early detection could help reduce the cost of damage from undetected water and moisture inside walls, currently estimated at millions of dollars per year.

Timeline

This research project is expected to be completed by August 2007. Additional research projects are expected to follow if the first phase is successful.

Cooperators

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