

A wireless system for monitoring the internal temperature and humidity values of different types of wood

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Presentation Outline

I. Introduction

II. The wireless sensor system

III. Experimental description

IV. Experimental results

V. Conclusions

I. Introduction

The Objective

Objective of this work:

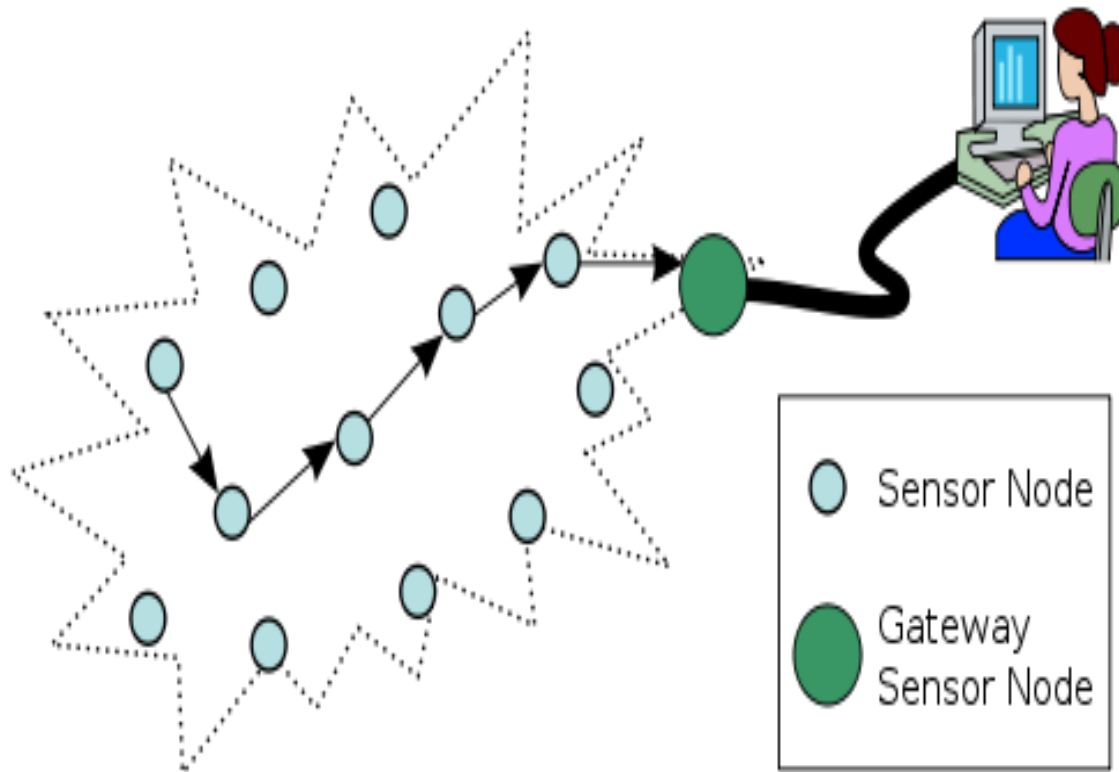
To study how the environmental conditions affect the wood quality using WSNs.



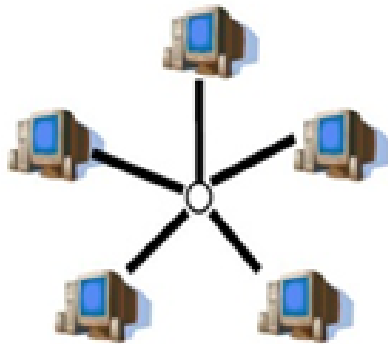
Wired vs. Wireless Systems

	Advantages	Disadvantages
Wired systems	Large memory High computational speed and bandwidth	Expensive Difficult to install
Wireless systems	Cheap Easy to install Small size	Poor memory Low computational speed and bandwidth Power supply

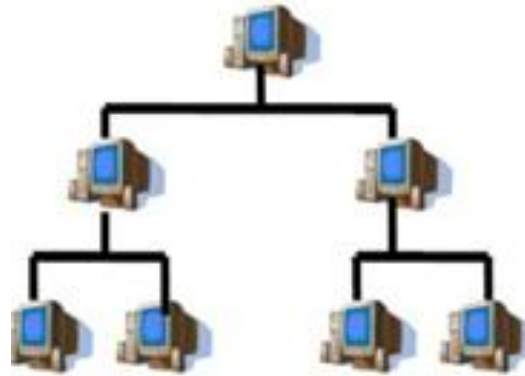
Routing algorithms



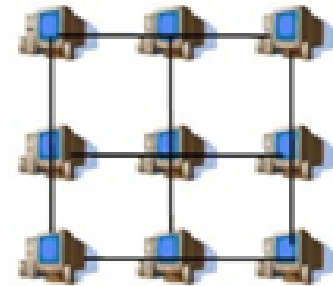
Routing algorithms



Star



Tree



Mesh

II. The wireless sensor system

Hardware Platform: Motes

IRIS Motes (MEMSIC Company)



Atmega1281 microcontroller, 8KB RAM, 128KB ROM and 512KB EEPROM

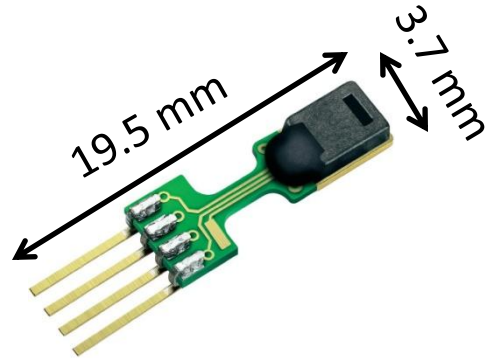
Radio Chip RF230, 2.4 GHz, IEEE 802.15.4

Bandwidth bounded 250 kilobits/s

TinyOS-2.x, NesC

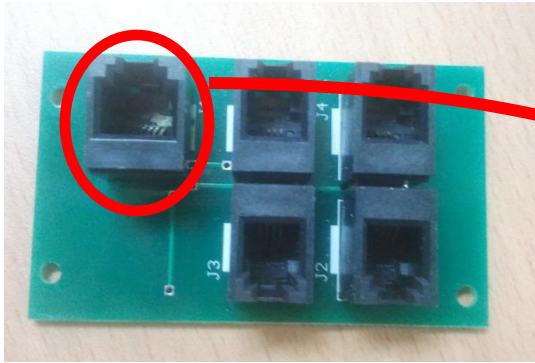
Hardware Platform: Sensors

Temperature and Relative Humidity sensors (Sensirion Company)

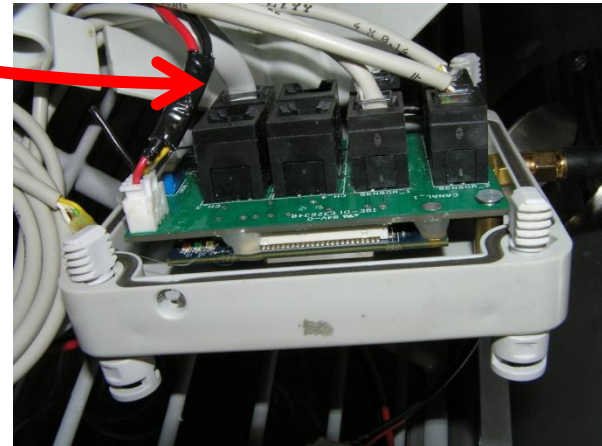


SHT75 sensors

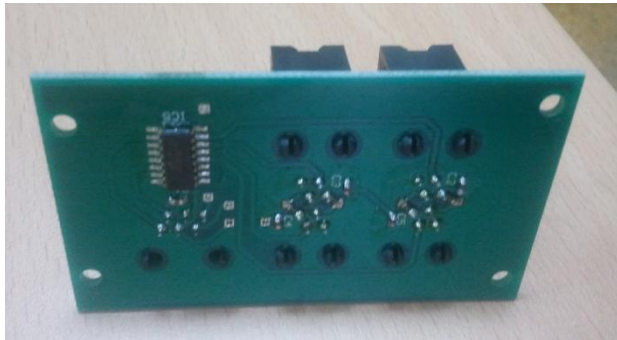
Hardware Platform: Multiplexer



Connected



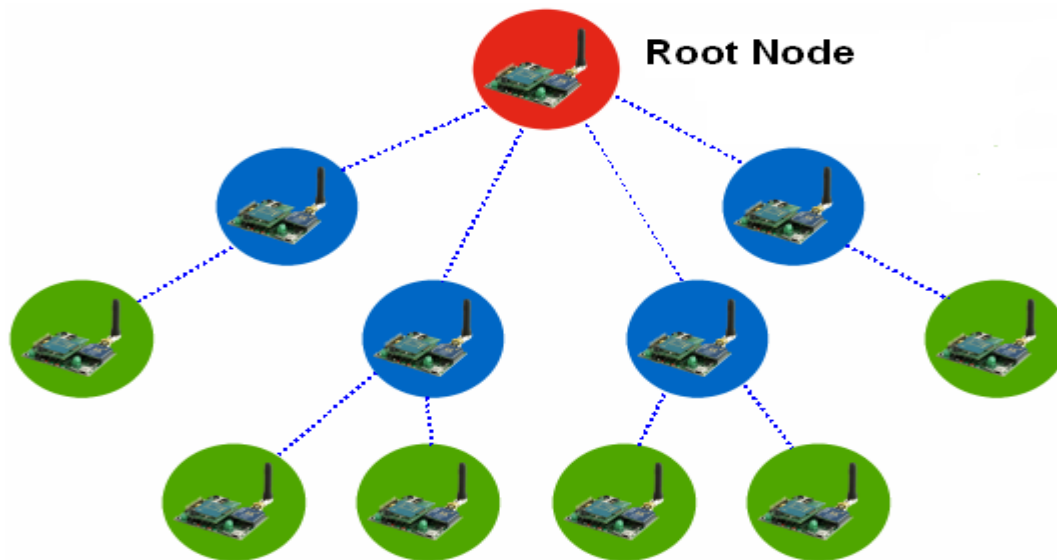
Sensorized Mote



Multiplexer

Routing algorithm: CTP

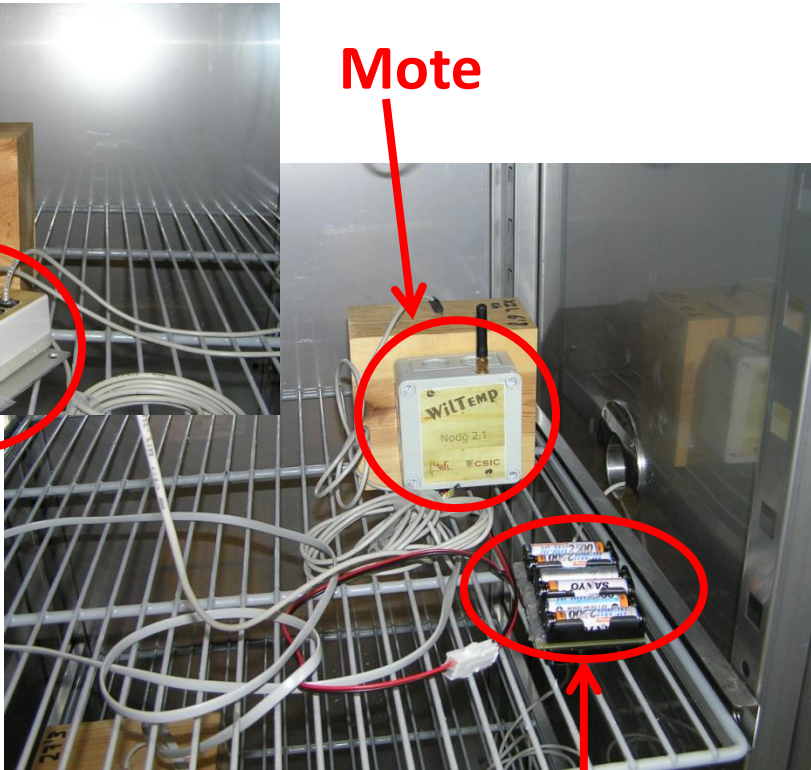
CTP is a tree-based collection protocol



The Wireless sensor system



Multiplexer



Mote

Batteries



Base station

Aparicio S., Ranz J., Molero M., Hernández M.G., Anaya J.J.
Performance of a tree routing topology for wireless sensor networks using different platforms.
Horizons in Computer Science Research, Vol 9. Nova Science Publishers, 2014.

III. Experimental description

Experiment deployment

3 different scenarios with diverse environmental conditions were selected:



Madrid
(IETcc, CSIC)



Seville
(«La Hampa», IRNAS-CSIC) (Catholic University, UCAV)



Avila
(Catholic University, UCAV)

Galván J. et al.

Methodological approach to the evaluation of the CLT for use in service class 3.

Technical Workshop: Designing with bio-based building materials - Challenges and opportunities. Madrid, 2016.

Experiment deployment

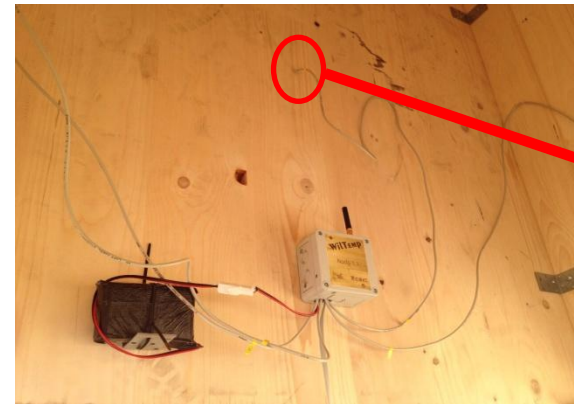
2 different wood basins were monitored during 6 months:
pine and fir.



Experiment deployment

Each wireless sensor system was composed of:

➤ 1 sensorized mote
+ 1 multiplexer



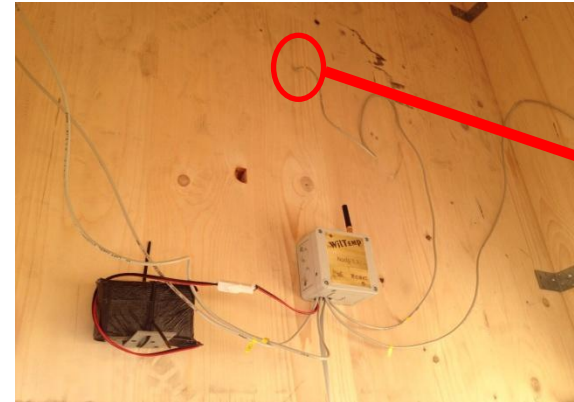
8 SHT75 sensors
Measurements
every 5 minutes.
Hole: 1cm
diameter and
sealed.

➤ 1 base station



Experiment deployment

Each wireless sensor system was composed of:

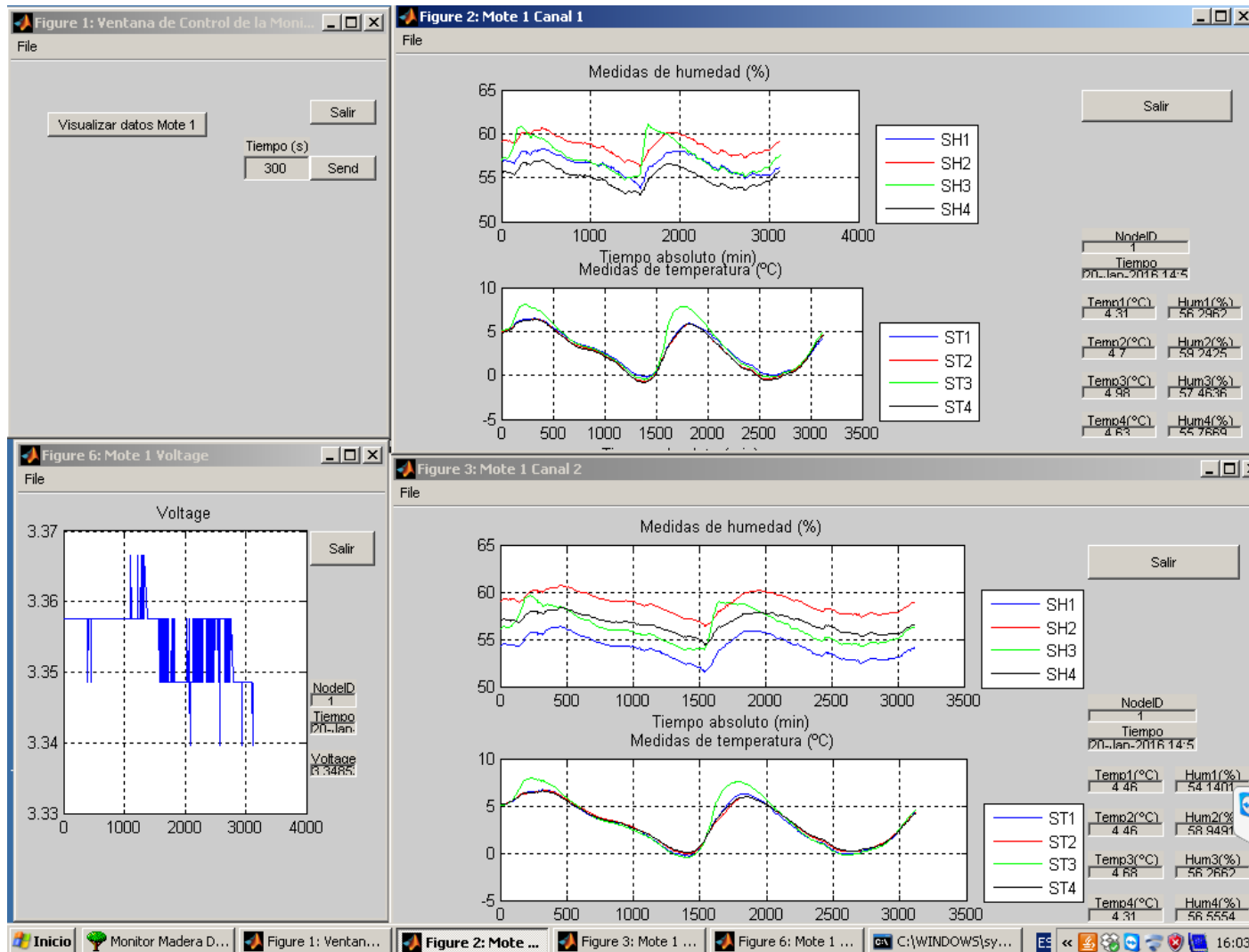


8 SHT75 sensors
Measurements
every 5 minutes.
Hole: 1cm
diameter and
sealed.

➤ **1 base station**

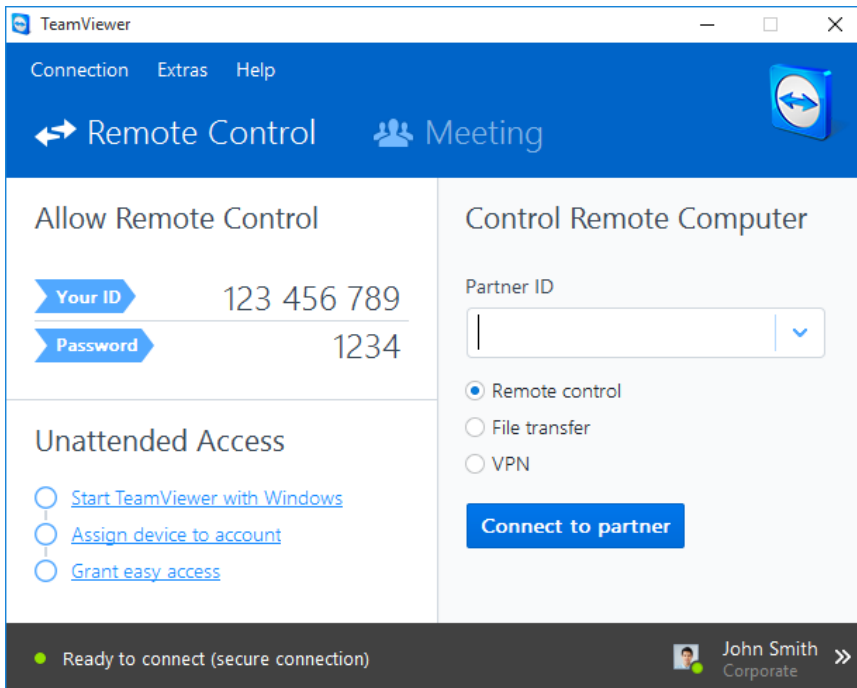


Experiment deployment



Experiment deployment

The system was controlled remotely using the **TeamViewer Desktop** and the data was saved in **Dropbox**:



IV. Experimental results

Problems

- 1. Power outage affecting computers receiving the data.**
- 2. Problems in communication between base and sensorized mote.**
- 3. Sensor faults due to water ingress.**
- 4. Condensation.**
- 5. Dependence of relative humidity with temperature.**

Solutions

1. Power outage affecting computers receiving the data.

Use low-power computers with independent power.

2. Problems in communication between base and sensorized mote.

Install repeaters to increase power of transmitted signal.

3. Sensor faults due to water ingress.

Tilt the sensor cavity to avoid the accumulation of water  Goretex filter

4. Condensation.

Use new generation humidity sensors  Drying mode to remove condensation.

5. Dependence of relative humidity with temperature.

The relationship between the humidity and temperature of the cavity, and the moisture of the wood will be established by the Dyken procedure.

Dyken T., Kepp H.

Monitoring the Moisture Content of Timber Bridges.

International Conference on Timber Bridges (ITCB 2010).

V. Conclusions

Conclusions

- **Our monitoring systems have proven to be useful in the wood application.**
- **Solutions were proposed for problems identified. They will be implemented.**
- **None of the identified problems compromise the results of this work, since only a very limited amount of data was affected with little influence on the general behavior.**

Thank you very much!