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Implementing wireless sensor networks for architectural heritage conservation

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Preventive conservation in architectural heritage is one of the most important aims for the development and implementation of new techniques to assess decay, lending to reduce damage before it has occurred and reducing costs in the long term. For that purpose, it is necessary to know all aspects influencing in decay evolution depending on the material under study and its internal and external conditions. Wireless sensor networks are an emerging technology and a minimally invasive technique. The use of these networks facilitates data acquisition and monitoring of a large number of variables that could provoke material damages, such as presence of harmful compounds like salts, dampness, etc.

The current project presents different wireless sensors networks (WSN) and sensors used to fulfill the requirements for a complete analysis of main decay agents in a Renaissance church of the 16th century in Madrid (Spain). Current typologies and wireless technologies are studied establishing the most suitable system and the convenience of each one.

Firstly, it is very important to consider that microclimate is in close correlation with material deterioration. Therefore a temperature(T) and relative humidity (RH)/moisture network has been developed, using ZigBee wireless communications protocols, and monitoring different points along the church surface. These points are recording RH/T differences depending on the height and the sensor location (inside the material or on the surface). On the other hand, T/RH button sensors have been used, minimizing aesthetical interferences, and concluding which is the most advisable way for monitoring these specific parameters.

Due to the fact that microclimate is a complex phenomenon, it is necessary to examine spatial distribution and time evolution at the same time. This work shows both studies since the development expects a long term monitoring.

A different wireless network has been deployed to study the effects of pollution caused by other active systems such as a forced-air heating system, the parishioners presence or feasts and other ventilation conditions.
Finally weather conditions are registered through a weather station. Outside and inside conditions are compared to incorporate data to the network for a later decay modeling.
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