Wireless sensor network testbed: A gateway for future solutions

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MI²T-WSN is a multi-level infrastructure of interconnected testbeds of large-scale WSNs. MI²T-WSN consists of 1 000 sensor motes that will be distributed into four different testbeds. The variations of these testbeds will allow for the implemention and testing of algorithms and protocols that could be used for various applications and within several types of environment.

INTRODUCTION

A large number of research publications have shown that wireless sensor networks (WSNs) are a promising approach that could provide future solutions for several problems. Although there are thousands of research publications in this field, there is still a gap between the research and the real implementation.

Most of the research that has been done has used simulation tools or a small number of nodes, which could not lead to reliable solutions for large-scale WSNs.

To narrow the gap between the research environment and real implementation we need to create a multi-level infrastructure of interconnected testbeds of large-scale WSNs (MI²T-WSN). As shown in **Figure 1**, MI²T-WSN could be used as a tool to open the door for future solutions. Moreover, MI²T-WSN would facilitate advanced research in WSN technology, enable the conducting of large-scale experiments that are not feasible with traditional small-scale testbeds and help other universities and institutes to build similar or smaller testbeds.

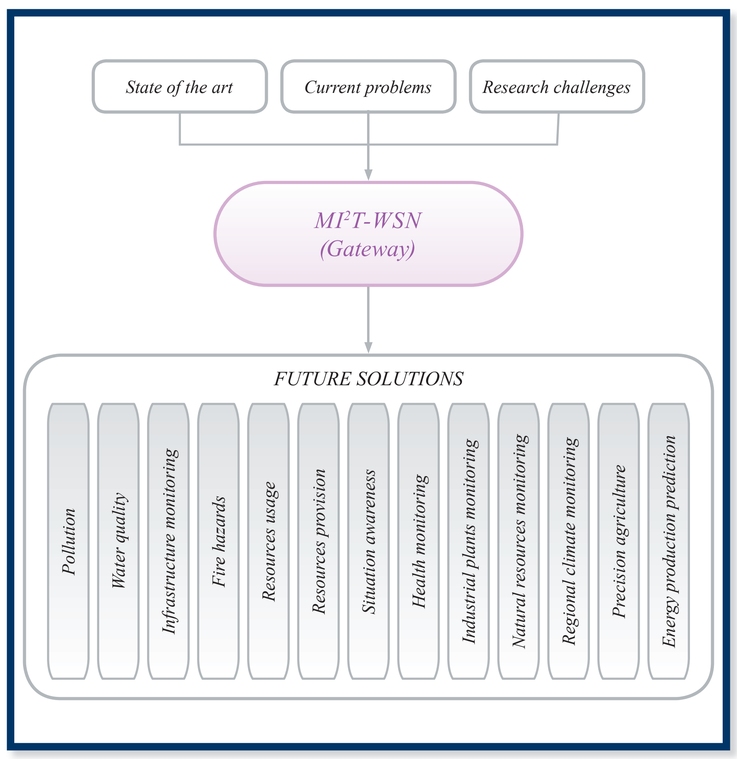

Figure 1: MI²T-WSN could be the gateway for future solutions

TESTBED ARCHITECTURE

MI²T-WSN is a large-scale wireless sensor network laboratory that consists of 1 000 motes (Waspmote) with heterogeneous sensing devices. MI²T-WSN consists of four testbeds: indoor-lab, indoor-real, outdoor-lab and outdoor-real. The indoor-lab testbed consists of 100 motes that are distributed inside a laboratory; the indoor-real testbed consists of 300 motes that are distributed in the offices, boardrooms and passages of a building; the outdoor-lab testbed consists of 200 motes distributed above the roof; and the outdoor-real testbed consists of 600 motes distributed outside at multiple sites.

IMPLEMENTATION

MI²T-WSN will be constructed in two phases. In phase one, the indoor-lab and indoor-real testbeds will be constructed. In the second phase, the other two testbeds, outdoor-lab and outdoor-real testbeds, will be constructed. In this poster, the focus will be on the first phase of implementation.

In the indoor-lab testbed, the sensor motes will be distributed in a grid network as shown in **Figure 2**. For constant power to the motes, two professional, testbed-grade 49-port USB hubs will be used to connect these motes to the power supply. In the indoor-real testbed, the motes will be distributed inside the building in different locations such as offices, boardrooms and passages. Each room will typically contain a small cluster of more than two nodes. To practically power these devices without using too much of the available power outlets in the building, smaller AC powered USB hubs can be used. Each cluster can be connected to a hub and distributed in the room using active USB cables. All the sensor data will be sent wirelessly to the Meshlium gateways to store it locally or in an external database.

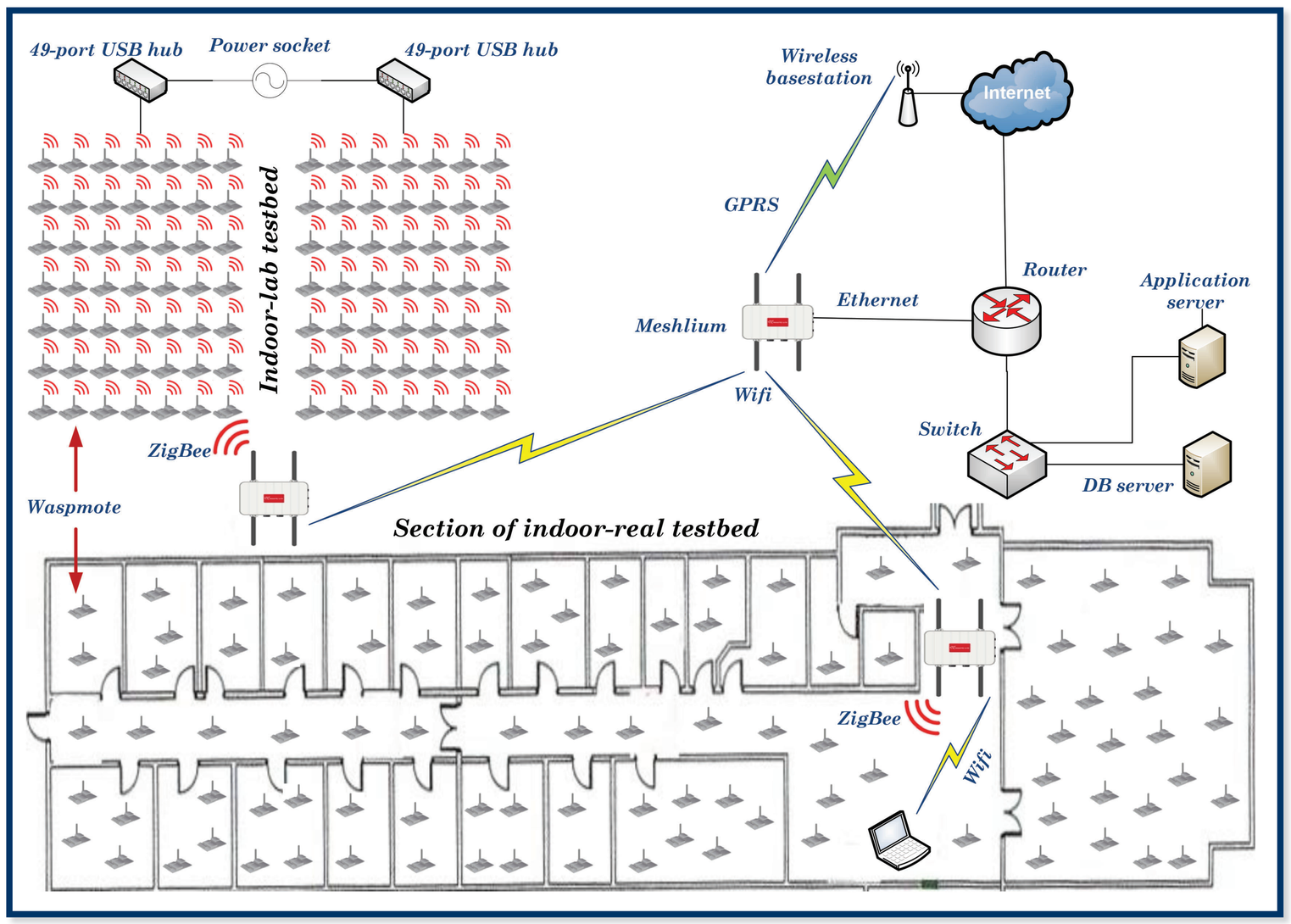

Figure 2: MI²T-WSN network architecture

ACCESSIBILITY

One of the main objectives of MI²T-WSN is to develop a real-time system that operates and analyses the environment continuously, and is able to rapidly detect and report abnormal variations. MI²T-WSN should identify end-users' needs requirements as well as operational constraints. In order to achieve these objectives, MI²T-WSN will use a web-based interface that can be accessed remotely, as shown in **Figure 3**.

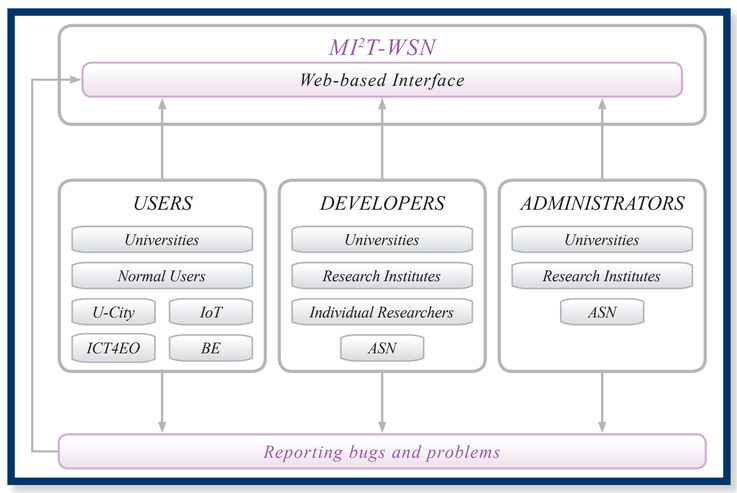

Figure 3: Remote access through a web-based interface

RESEARCH DIRECTION

Figure 4 proposes a research direction for implementing, testing or developing state-of-the-art or new protocols and algorithms. This framework encourages researchers to perform three steps before the start of real-world implementations: simulation tools, lab-testbeds and real-testbeds.

Figure 4: Research direction

CONCLUSIONS

MI²T-WSN is a unique laboratory because:

- It is a large-scale WSN that consists of a multi-level infrastructure of indoor and outdoor testbeds.
- It is a multi-disciplinary testbed that can be used for several applications and environments.
- It can be accessed remotely using a web-based interface.

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