

# Network-enabled Sensing Robot Emulation

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**Abstract**—We will perform a demonstration of our research on sensor systems through the use of emulation on the particular case of network-enabled sensing robots. The experiment will be performed remotely using Virtual Private Network (VPN) technology on StarBED, the large-scale experiment environment of the National Institute of Information and Communications Technology (NICT), Hokuriku Research Center in Ishikawa, Japan.

**Keywords**—sensor systems; network-enabled robots; emulation; remote experiment execution

## I. INTRODUCTION

We propose to perform a demonstration of our research on sensor systems through the use of emulation on the particular case of network-enabled sensing robots. We emulate such robots on StarBED, the large-scale experiment environment of the National Institute of Information and Communications Technology (NICT), Hokuriku Research Center in Ishikawa, Japan. The testbed that we develop allows studying various network-enabled sensor systems through emulation in virtual environments. This makes it possible for researchers to test their algorithms and implementations in realistic conditions. In order to achieve this goal the sensor system implementation is interfaced with emulation modules that allow it to interact with other systems and the surrounding environment in the virtual space that we create, as illustrated in Fig. 1.

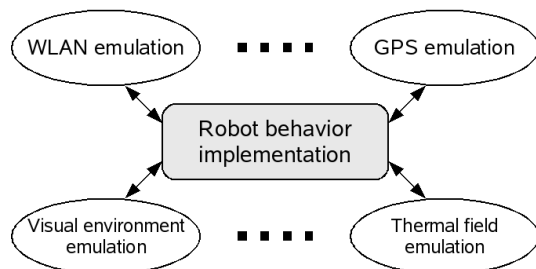


Figure 1. Our approach to studying network-enabled sensing robots through emulation.

In the case of network-enabled sensing robots that we will demonstrate, we consider the robots to be equipped with GPS sensors, visual sensors and 802.11b WLAN interfaces. GPS sensors allow robots to determine their position. Visual sensors allow them to identify obstacles and other robots

visually, as well as map the topology of the close-range environment. WLAN interfaces make it possible for robots to interact with each other, exchange planned motion trajectories, and consequently readjust their trajectories in real-time. All these sensors are emulated in our experiment by corresponding emulation modules, and the information provided by them is supplied to the robot behavior implementation, which uses it for motion-planning purposes.

## II. DEMONSTRATION DESCRIPTION

The demonstration we want to perform will show how it is possible to study network-enabled sensor systems through emulation using the particular example of robots. The demonstration we propose will take place as following. We will start remotely the experiment of robot emulation that will be effectively performed on the testbed of the Hokuriku Research Center in Japan. While the experiment is running, the audience is able to follow its progress through a visualization interface, as illustrated by the screen caption in Fig. 2. Prior to running the experiment we need to connect remotely to StarBED using the VPN of the testbed. This can be done from any PC on which the VPN software is installed, provided that the corresponding short-term password device is available. We will lead the audience through all the easy steps of this procedure. In the end we will discuss the results obtained and the advantages of using such an emulation system for real-time testing of network-enabled sensor systems.

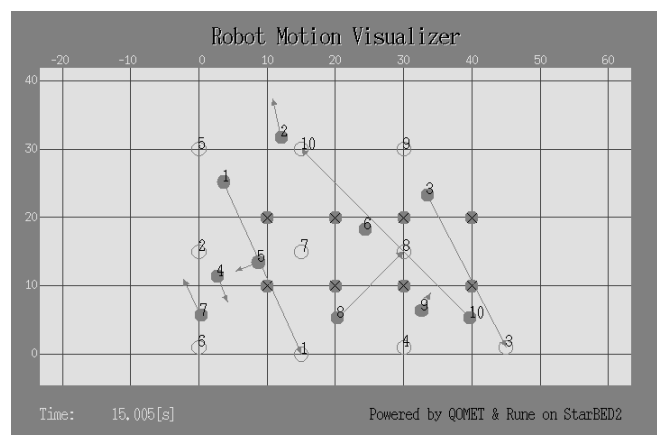


Figure 2. Experiment visualization interface.