

Sensors Network Based on Mobile Robots

Victor Ababii, Viorica Sudacevschi, Marin Podubnii, Irina Cojuhari

Technical University of Moldova

Chisinau, Republic of Moldova

ababii@mail.utm.md, svm700@mail.ru, marinpodubnii@mail.ru, irina.cojuhari@ati.utm.md

Abstract—This paper describes a sensor network design based on a mobile multi-robot system. System topology is a distributed computing architecture that consists of a PC Server, Local Area Network (LAN) with Wireless Access Points (WAP), a set of Master Mobile Robots with gateway features and a set of Slave Mobile Robots, grouped according to their investigation tasks. The concept of data acquisition control is based on the PC Server general strategy, which is distributed to each Slave Robot via Master Robot. Master Robots fulfill the Gateway function for data transmission through Transmission Control Protocol/Internet Protocol (TCP/IP) and Radio Frequency Communication (RFC) networks using appropriate communication protocol. The functionality of the designed system has been checked on a network with four sensors that measures the temperature gradient around a heat source.

Keywords—multi-robot systems; wireless sensor network; VI LabVIEW; strategy control; mobile master robot; mobile slave robots

I. INTRODUCTION

Mobile autonomous robots are able to accomplish many tasks in real environments, dangerous for humans, such as places with high temperatures or harmful gaze concentration. Systems that consist of several robots can present advantages over those that include a single robot. A robot team can cover an area faster and can perform the exploration tasks better. Microcontrollers, actuators and sensors that are parts of robot systems provide the robots navigation through an environment. Successful execution of a task depends a lot on the ability of robots to orient in an unknown environment [3].

A special interest presents multi-robot coordination in order to achieve a complex task. One of the most popular solutions is the use of a strongly centralized architecture, where a central unit is responsible for taking any decision, and the peripheral units operate consequently. This fact does not restrict the autonomy of the single unit, as every robot can decide how to realize the command that the leader provides for it. The involvement of each robot in collective decision in order to reach a group consensus is an important task to be solved [1]. A collective decision can be defined as a global strategy followed by a leader robot and individual strategies, provided for each robot in the team. Strategy in this case represents an extrapolation function of a Multi-Robot system behavior on a defined time interval [2, 3].

The paper describes the design of sensor networks based on a mobile multi-robot system, the characteristics of which are: mobility, given by the robot system, centralized strategic control, the use of Wireless Sensor Network (WSN) [6] to store data, data processing in virtual design environment VI LabVIEW [5].

II. MOBILE ROBOTS SENSORS NETWORK STRUCTURE

Multi-Robot System is organized as a distributed computing architecture (Figure 1).

Multi-Robot System architecture includes: PC Server - server for data storage and processing; WSND 1.2 - Wireless Sensor Network Domain Investigation (Control Area); WAP - Wireless Access Point; MR/GW - Master Robot and Gateway systems; SR/S - Slave Robots and Sensors; RFC - Radio Frequency Communication, Wi-Fi - Wireless Fidelity [4].

The system operation. Strategy Control Application generates control strategy that is sent through LAN to Master Robot MR/GW. The Master Robot, in turn, distributes to each Slave Robot SR/S the activities for next timeframe. Slave Robot performs data acquisitions, which are sent to the server through the Master Robot. The received data are processed by LabVIEW Application.

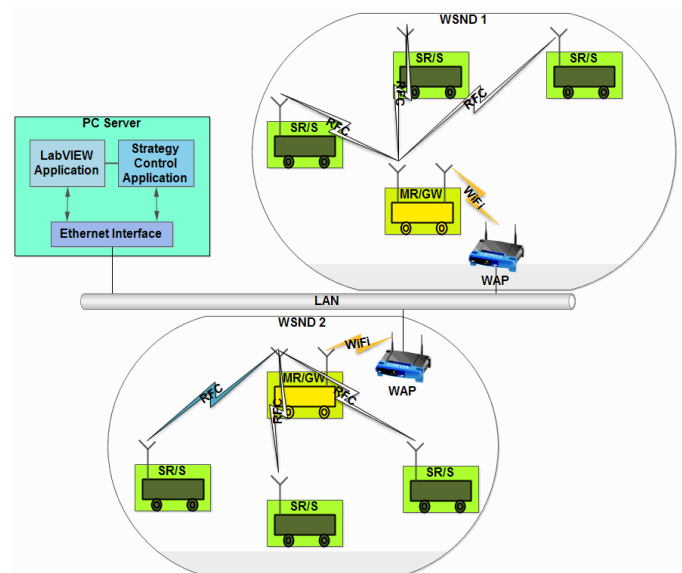


Fig. 1. Multi-Robot System Structure.