Artificial Vision system for differential multiples robots

***Abstract*— Multi-robot systems (MRS) have become a promising area in mobile robotics, in applications in which a coordinated action is required. This paper presents an Artificial Vision System (AVS) for a multi-robot platform, developed at the Universidad Nacional de Colombia (at Medellín) with academic and pedagogical aims. The artificial vision system may be viewed as a subsystem of the MRS and is composed by three basic elements: The environment, the camera, and the processing unit. The Artificial Vision System implements color spaces, threshold techniques, and noise elimination for obtaining in real time the relative positions of the robots in the working area. 200 instance images were used as testing set. The obtained algorithm is able to suitably eliminating image noise, and extracting and identifying labels of the robots for around 80 % of the testing set. Beyond that, the implemented system may serve as an experimentation platform for subjects as diverse as image processing, control, instrumentation and robotics.**

Index terms — Artificial Vision; color spaces; Multi robots systems; thresholding.

I. INTRODUCTION

This work describes the development of an experimental platform based on artificial vision, aimed to serve as a support of some of the courses imparted in Universidad Nacional de Colombia. The whole Artificial Vision System (AVS) is described as well as the design implications involved. The platform was implemented by means of a collaborative work of several university students, and by exploiting an academic resource known as Special Academic Practice. Such a figure allows the students to develop a project along an academic semester and counts as a regular course of each student's career.

II. WORK DESCRIPTION

Practice stands as a very useful and effective way of transfer knowledge, especially for engineering areas, since it provides experimental and tangible proof of theoretical concepts, and develops skills for the professional life. By means of Special Academic Practices, which may be viewed as a project-based approach which last one semester, several students have developed a platform of multi-robots which are controlled by an artificial vision system.
The platform is composed by a set of differential robots, which move along a two dimensional space. Above such two dimensional space, a camera captures the relative positions of the set of robots. The images captured by the camera are processed by a personal computer, which uses artificial vision techniques for identifying and locating each robot. Position information is compared to a desired trajectory control, and corrective actions are transmitted to each robot, by means of a wireless link. The developed platform served as an excuse for providing a practical experience to some students of Universidad Nacional de Colombia, and as an experimental and practice instrument for future courses imparted at the same university.

III. OBTAINED RESULTS

Regarding technical results, the artificial vision system is able to locate the robots with an effectiveness of around eighty percent. The wireless communication system, which was based on the *Zigbee* protocol as well as the control software located at the computer, worked correctly. With respect to the academic elements, the project development was attended of around eight undergraduate students of the Control Engineering career. Each of them enrolled a Special Academic Practice as regular course and contributed to the platform design and implementation. Finally, it is expected that the same platform to serve as a practice instrument for several courses at the university, since it allows approaching to several areas such as robotics, telecommunications, artificial vision, control, software programming, and so on.

IV. REFERENCES

A. I. Mourikis and S. I. Roumeliotis, “Performance analysis of multirobot cooperative localization,” IEEE Trans. Robot., vol. 22, no. 4, pp. 666–681, 2006.