RFID TRACKING SYSTEM TO STUDY THE BEHAVIOUR OF SPECIES

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INTRODUCTION

The present work describes a tracking system development using RFID technology for the study of species in laboratory. The species under analysis carry a small transponder which is powered from the field induced by the readers (antennas) positioned in the area of interest or study. The transponder transmits the UID (unique identifier) to the reader and a control system collects the information from all of them, therefore, it is possible to trace the movement of several individuals at the same time. The position is directly extracted from the location of each reader.
The developed system has been introduced in an aquarium of 150x70cm for the study of Nephrops norvegicus (L.), decapod crustacean that lives in complex burrows in the Atlantic and Mediterranean, whose existing population is unknown and capture has a great economic interest.

OBJECTIVES

The main objective is to design a tracking system to study species with a resolution of centimeters. Some species are sensitive to the method and conditions of the measurement, so its activity may be disrupted, the system has to be non-intrusive. In addition, we wanted to monitor multiple individuals at the same time, a system easy to expand and able to study any kind of animals.

SYSTEM DESIGN

The system structure is shown in Figure 1, the design contains parallel modular systems that control a number of antennas, which are positioned in our case, below the aquarium. The individuals under analysis carry a passive transponder (no battery) of small size (2.5cm diameter) that transmits its UID to the antenna.

The designed control system (RFID Controller) handles readers. This system is governed by a low-performance microcontroller that implements the readers communication protocol and time multiplexing of the UART to communicate with them. The system is able to control up to seven readers, with one second refresh rate (7 antennas per second).

Because the RFID controllers work in parallel, we can find the position of all individuals in the study area every second. In our case, the area has 42 antennas (Figure 2). The RFID controller communicates with the central computer using the USB interface, it is a flexible design and is easy to expand. A LabVIEW application manages all devices connected (RFID Controllers) and stores all tracking data during the experiment.

RESULTS AND TESTS

As it is known, the RF signals have a great attenuation under water, a comparative study was needed to ascertain the level of coverage through different readers 125 KHz, 13.56 MHz and different types and sizes of transponders. Finally, although at a 125 KHz we got very good results under water, we chose a reader with an operating frecuency of 13.56 MHz, with which we got correct detections at a maximum distance of 7cm. Other factors that we had in mind to choose the reader were, the anticollision (detection of multiple transponders on the same antenna) and the antenna size (if frequency increases, the size decreases) which can improve the resolution and accuracy of localization.

CONCLUSIONS

A tracking system with RFID technology has been developed, this design has a distributed topology and offers a great flexibility and it is easily expandable; we only have to connect to the USB ports of the controllers and antennas. It is important to indicate that the system is not dedicated to study a particular animal but any kind of animals that move on the ground, solving and offering an open system with a nonexistent technology in the market.

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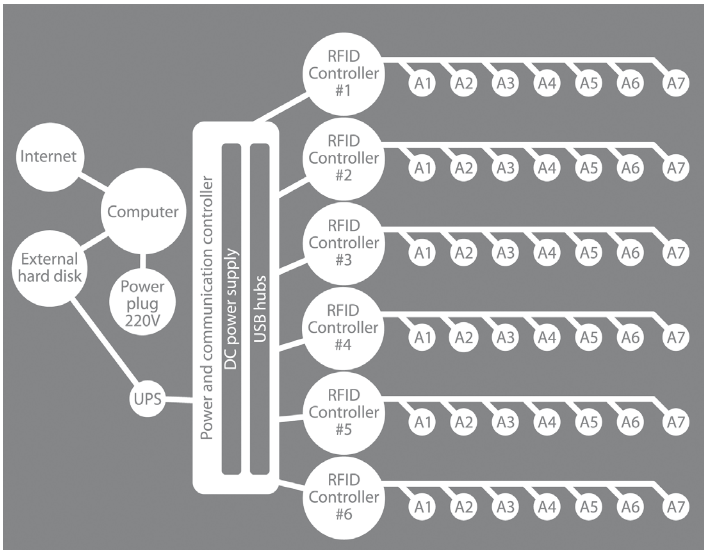

Figure 1: Complete system structure

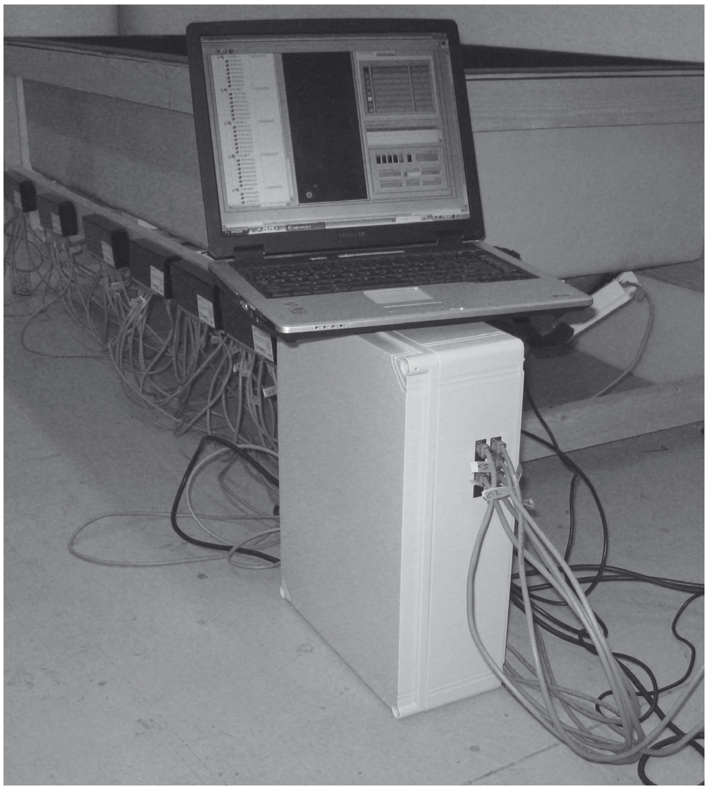

Figure 2: System developed and assembled