CATRAPILAS – A Simple Robotic Platform

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Abstract. This paper describes Catrapilas, a small robotic platform, designed to be capable of solving some well known robot problems. Among these are some of the most popular robotic contests, like Micro Mouse, Fire Fighting and Autonomous Driving. It describes the major decisions and details of the physical architecture of the robot, but emphasizes on the high level approach used to control the robotic agent. This approach is based on the creation of a 2D map of the agent's environment, which should contain all the information needed in order to solve the current problem. There is also a description of the implementation used for the Autonomous Driving Competition, from the 2005 Portuguese National Robotics Festival, and the results that were obtained. There is a focus on the robot's ability to accomplish the objectives of the contest, and how this proved that the concept and ideas behind Catrapilas are correct.

1 Introduction

The major goal of robotic contests has always been to promote the growth and advance of all the sciences involved in the construction of inteligent robots for many tasks that until now were only performed by humans. Despite the controversial question of whether the competition side of these events brings more benefit than not, it is undeniable that many advances were achieved due to the sharing of ideas and the imitation of some ot the most useful features of the other robots. Among these contests are Micro Mouse [2] [3], Fire Fighting [4] [5] and Autonomous Driving [6].

But this sharing has some setbacks. In the early ages of small robot competitions the only possible approach was based on a completely custom made solution. Now, as then, the most natural approach to some parts is still based on a custom made solution. This is particularly true in mechanic components (motors, wheels...) and in hardware (sensor configuration mostly), since these are the physical components that could make a difference between equally "smart" robots.

The common practice in some of these contests is to use simple microcontrollers on the control part of the hardware. Maybe because the study area of the majority of the contestants is electronics, there is a normal tendency to use this kind of technology. However, computer technology has suffered so many breakthroughs that it's possible to fit one PDA or PC, with a processing power several

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dozen times bigger, in the space occupied by one of these simple microcontrollers. Processing power alone is a good justification for choosing this kind of technologies, allowing the use of Computer Vision and more complex techniques and algorithms. But this is not the only advantage. Computer technologies also simplify a great deal of tasks like using a camera or any other standard connection device (using USB, IEEE1394[1]). It's also very probable that some parts of the system (image processing libraries [7], data structures, etc...) were already been done by somebody else and might even be free to use. And in the future it will be possible to buy a new, cheaper and more powerful PC and easily use the same software previously implemented (maybe with minor changes).

All these advantages assert this approach as a good one. This idea is also shared by Sony, the company that is investing more in robotics for personal use worldwide, with its Aibo.

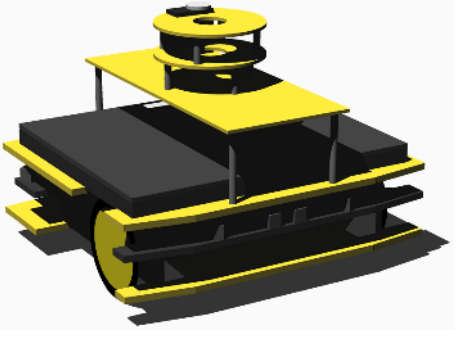

Fig. 1. Catrapilas 3D design

2 Catrapilas Architecture

2.1 Mechanics

Chassis. The robot chassis is made of expanded PVC plastic, due to it's extremely low weight, good structural resistance and easy crafting. It is composed by several decks that support all the electronics and mechanics needed and that also provide a good weight distribution and an increase in the structural resistance. This structure can be seen in Fig. 2.

All the robot's design was made keeping in mind the final weight of the whole. The weight is very important for a mobile robot, because if the robot is heavy its motors must be more powerful. More powerful motors are not only more costly but are also heavier, and require more powerful batteries that are also heavier. These heavier components make the need for a more resistant chassis structure, which must also be heavier. This is a vicious cycle, that only stops on a much

[1] Commonly FireWire.