A Capture and Image Processing System for Humanoid Robots and the MauaBots Humanoid Team

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***Abstract*— This paper describes the development of a capture and image processing system for humanoid robots so that they become capable of identifying objects by color. The proposal includes the development of new hardware that will be applied in order to defining the actions that must be performed by humanoid robot for participate in the RoboCup Soccer Humanoid League.**

I. INTRODUCTION

Computer vision systems based on techniques of image processing have been used in a wide variety of applications in industry and society [1] – [7]. In the area of autonomous robotics or embedded in unmanned aerial vehicles, the use of machine vision systems to develop applications such as mapping of regions and obstacle detection, control of forest fires and environmental monitoring, inspection, security systems or even the implementation of the soccer robots.

Within this context, this project proposes to develop an embedded system for capturing and processing images that is capable to make the identification of natural landmarks by shape and color. This concept is applied at the MauaBots Humanoid Team that will participate on robotics competition during the LARC (Latin American Robotics Competition) in 2010.

II. THE COMPETITION

In the Humanoid League, autonomous robots with a human-like body plan and human-like senses play soccer against each other. In addition to soccer games, penalty kick competitions and technical challenges will take place. The robots are divided into two size classes: Kid Size (30-60 cm height) and Teen Size (80-130 cm height). Dynamic walking, running, and kicking the ball while maintaining balance, visual perception of the ball, other players, and the field, self-localization and team play are among the many research issues investigated in the Humanoid League.

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III. THE ROBOTS

The team consists of three ROBONOVA-I Humanoid robot shown in Figure 1, produced by HiTec. The robots present 16 servo motors and an electronic control board MR-C3024 that can be programmed using standard software. However the software is limited and does not allow the introduction of other desirable features for the robot soccer competition.

Fig. 1. ROBONOVA-I Humanoid Robot.

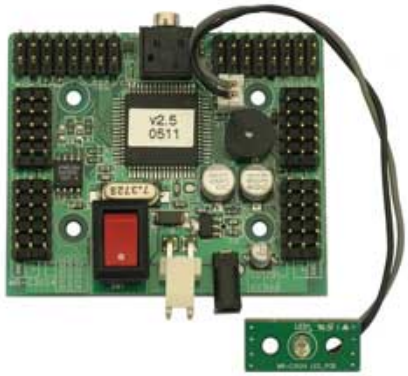

Fig. 2. PCB MR-C3024.

The PCB MR-C3024 allows to control of up to 24 servomotors using its digital input and output and has RS-232 and TTL serial communication. The power battery

pack consists of cells with five recharged units with 6 V and 1000 mAh.

The embedded solution proposed consists of the design of a new PCB that allow the integration between the ROBONOVA (with its servo motors), a camera (CMUCam2) and a ZibBee® module that permits the exchange of information between the robot and computer during the tests.

The new PCB developed is illustrated at Figure 3 and uses a 16-bit microcontroller – dsPIC – programmable in C. The microcontroller were programmed for perform the control of servo motors, the serial communication with ZigBee® module and allows the programming in-circuit.

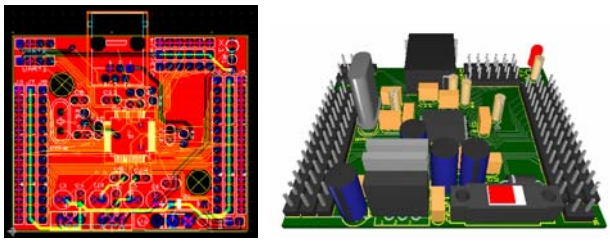

Fig. 3. Layout of the new PCB.

The devices that can be controlled using the new PCB are presented at Figure 4 that also presents the mechanical support developed in the project.

Fig. 4. Devices controlled by the new PCB and mechanical support for CMUCam2.

IV. The Strategy

The strategy of programming the robots was simulated step by step using slides in Microsoft Power Point (Figure 4) that turned easy to define the tasks for robot, each movement and the resulting new position of pipes.

The strategy is still being programmed at the embedded system. However at the applications is already possible to capture and process the image with success. The images are note stored in memory but are processed on-line using the CMUCam2. The program is able to recognize the responses sent by the camera indicating both the presence and absence of objects with specific color in order to define the desired action for the humanoid robot.

V. Conclusion

This TDP (Team Description Paper) presented briefly describes the robot and strategy being developed for participating in RoboCup Soccer Humanoid competition.

Many steps still to be accurately developed until the effective participation in the competition. But, the initial projects have already been developed and the next steps are being forwarded.

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