Strive(Small Size) Team Description 2008

Shanghai University, China
Box.3#, No. 149, Yanchang Road, Shanghai, China, 200072
wanmic@163.com
http://robocup.shu.edu.cn

Abstract:
This document describes the Strive(Small Size) preparing for the Small-Size (F180) League Robocup competition 2008 in Suzhou, China. It gives an overview about both the hardware design of the robot vehicle and the software system.

1) Introduction:
The Strive(Small Size) of Shanghai University was established in 2003. The team, so far, has participated in RoboCup-2006 Bremen, China Open 2006 and 2007 and China Robot Competition from 2003 to 2005. And we won the champion of Iran Open 2007. Our team's aim is to be competitive and excellent in the Robocup World Championship 2008 in Suzhou.

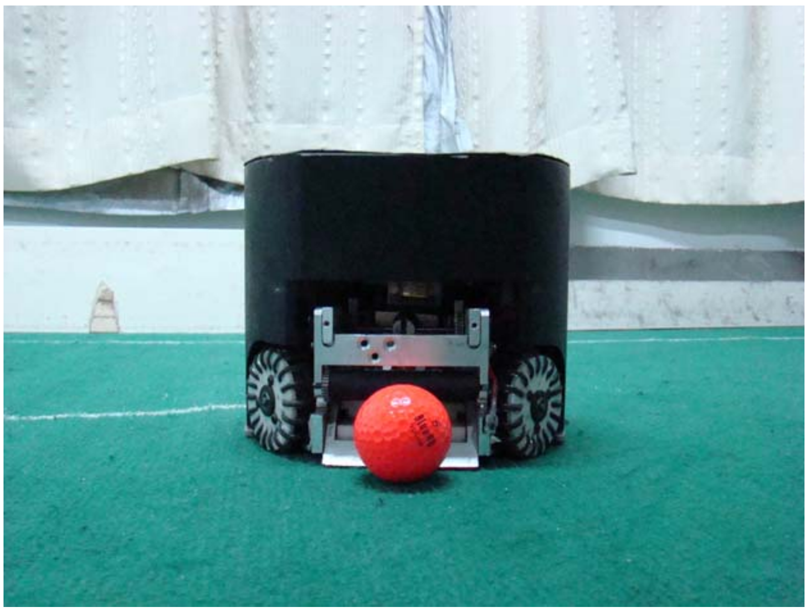

Fig.1 The appearance of our robot

2) System Overview:

2.1) Vision System:
With the help of two new cameras, AVT MARLIN F-033 C, our vision system is now able to work at 50fps. This can help to capture more exact positions of vehicles and the ball. Each camera is equipped with a wide-angle lens in order to observe the whole field information. The grabbers convert the analog data from cameras to digital data for post-processing at the same speed.
Its also provide SDK with fundamental function for visual system programming.

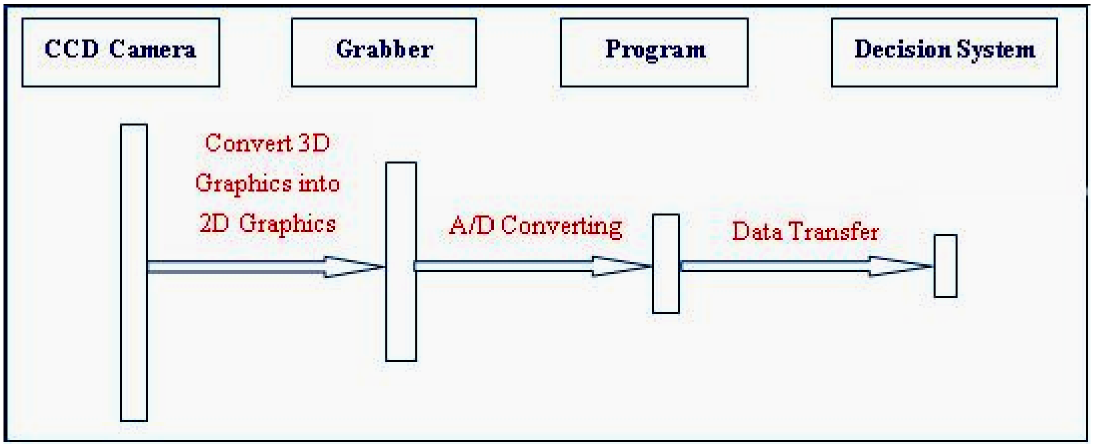

Fig.2 The flow chart of data processing

When the vision system starts to work, the program will set a timer with frequency of 50Hz. Then four buffers will be allocated, two of which are for RGB 24-bit image and others for grayscale image. We run two threads to search robots and ball respectively. In the first thread, edge detection is computed for converting grayscale image to binary image. Then the mask-marching process is held for searching the position of robots. In this process, the predestined mask is placed at every position of the field. The visual features of points similar to the masks' are determined as the positions of robots, therefore robot position coordinates of both our team and competitor will be located. Other color spots representing robot number in team around the team label can be found by sweeping around the center of our robots, by which the ID number and orientation of Roberts can be identified. In another thread, we search outwardly with the spiral way of rectangle from where the ball was identified in the last frame until we find the ball. All the data of robots, positions and orientations, acquired from two process threads, will be transferred to the strategy system rapidly.

Image distortion is unavoidable because of the wide-angle lens. So correction algorithm for barrel distortion and sloping are necessarily conducted. Moreover, since the height of robot is much taller than the ball's, there are relative errors of their positions in camera shooting image, and correction for height error is introduced to solve this problem.

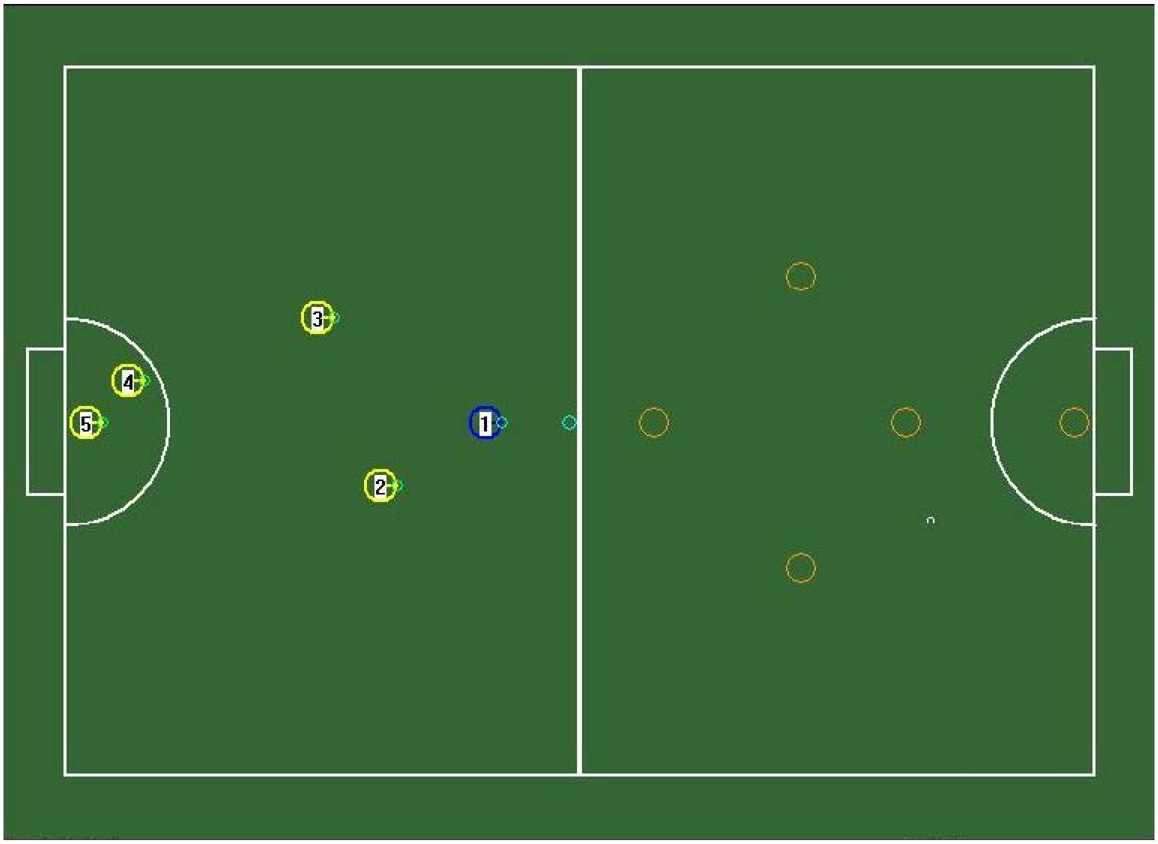

Fig.3 Output data

2.2) AI System:

According to recent game situation, we have improved our control software. We added new tactics for direct/indirect free kicks, which are able to make different decision under these circumstances. And a new way of velocity and acceleration is used to make our robots move more smoothly.

Our strategy bases on a dynamic role allotment system. Roles of our robots are not fixed; they may probably convert to another role at any moment. The system is also able to raise the efficiency of the tactics being carried out and avoid a completely tactics failure due to a mission failure of a single robot（in consideration of the variances between different robots and interferences from opponent robots）.

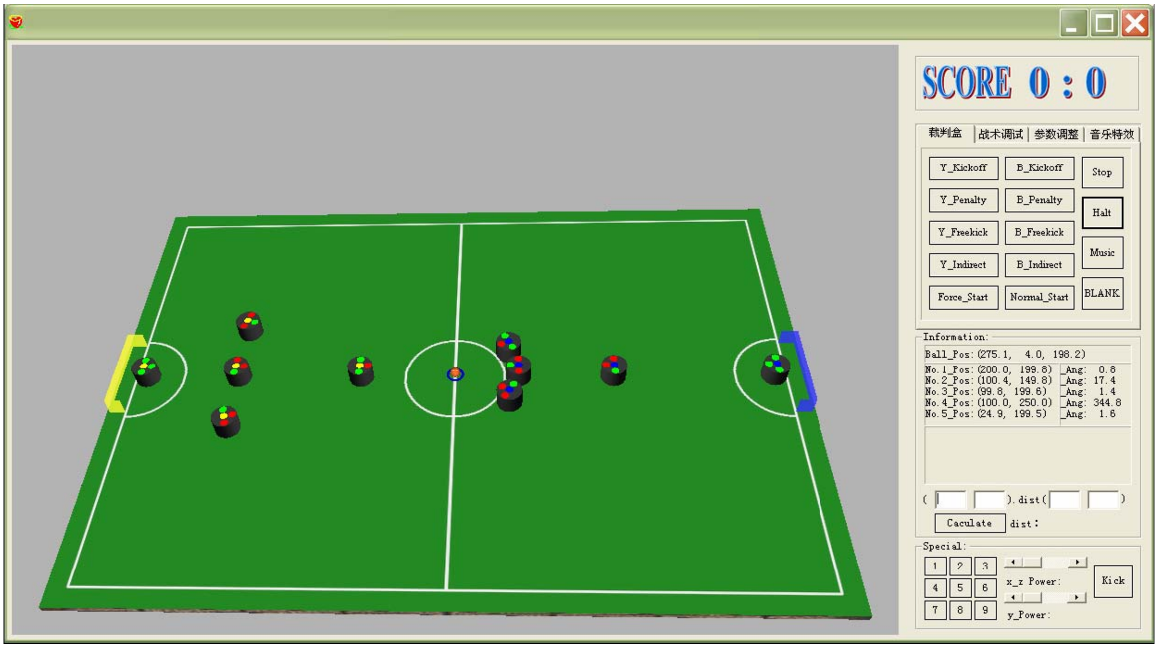

Fig.4 Snapshot of simulator

Because of high cost of robots working and inconvenient to parameters mediating, we develop an OpenGL based strategy simulator to aid our strategy research. The data recorded from every debugging or game are restored and accumulated in simulator system, which effectively contributes to game reconstructing, parameters rectifying and game rehearsing.

Using this software we can mainly aim at the weak points of our team. Lots of experiments could be conducted; variable processes and results could be experienced by applying different tactics or through parameters mediating until we get a contented result to enhance the competence of our team.

2.3) Electrical Design:

Our system is based on FPGA chips as before. The communication is controlled by FPGA which determines the configuration and status of the nRF2401 chip. The flow of data is sent to the FPGA, with which we establish dual ram. It also supplies a public buffer for the communication. This structure reduces the overall burden of system effectively. The motor driver is used by 4AM11 and the driver logical control is set up by CMOS combinational logic circuit. The flow of control is to be the dual-closed loop configuration which constitutes rotate speed loop and electric current loop. The model of the examining rotate speed is used by the motor’s incremental shaft encoder of itself and the model of examining current adhibits the model that voltage converts frequency. The kick-ball model is that the robot kicks off from the energy of the high voltage. The high voltage is gained by the conventional boost converter. The whole controlled model is separated from the driver model and high voltage model by the optocoupler.

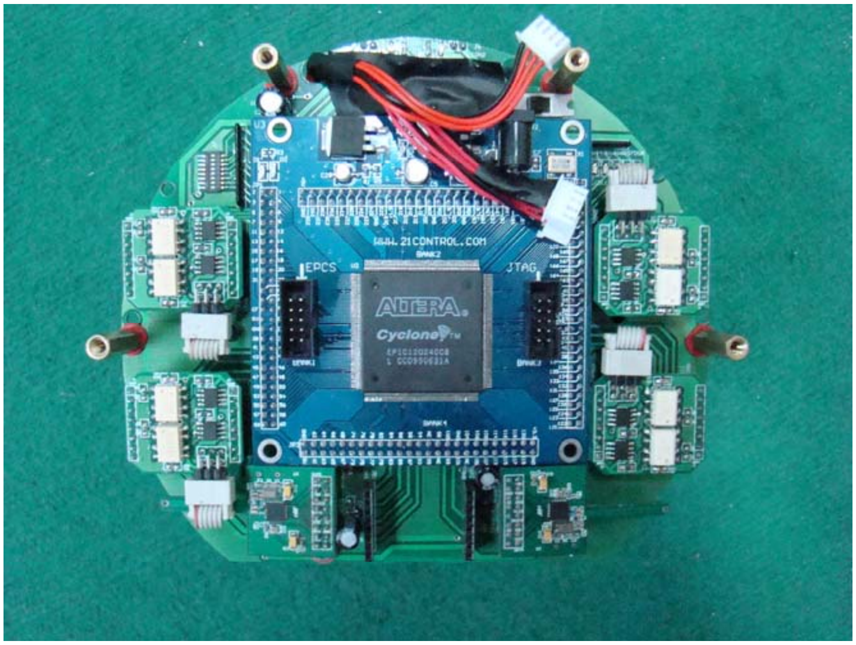

Fig.5 The circuit design

2.4) Mechanical Design:

Dribbling and kicking:

Our ball-control mechanism includes dribbling and ball-kicking. Different dribbler materials, diversified roller shape, variable gear ratio and changing the velocity of the rolling bar are considered and chosen. We add a triangle metal board to enhance the power of dribbling. We also increase the positive area of contacting the ball. In ball-kicking experiment, we use two solenoids which are more powerful than last year; one is for kicking and the other is for chipping. If we kick the ball above straightly, it can reach 120cm high. With the improvement of the solenoids, the power of ball-kicking has been raised more than last year.

Moving part:

Our driven motor is Faulhaber DC 2224U micro-motor. It can ensure our vehicles move at the speed of 3m/s and the acceleration can be reach $8m/s^2$.

Pass and Chipping part:

We can make short or long pass by adjusting the output power of the solenoid for kicking. We can chip the ball above the other robot although the two robots are very near. And now we try to adjust the distance and height of the ball when we chip the ball.

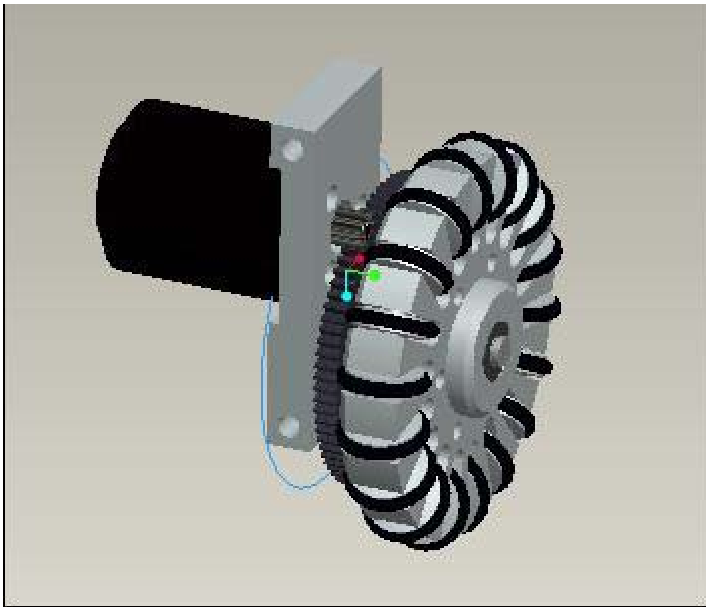

Fig.6 Motor and wheel

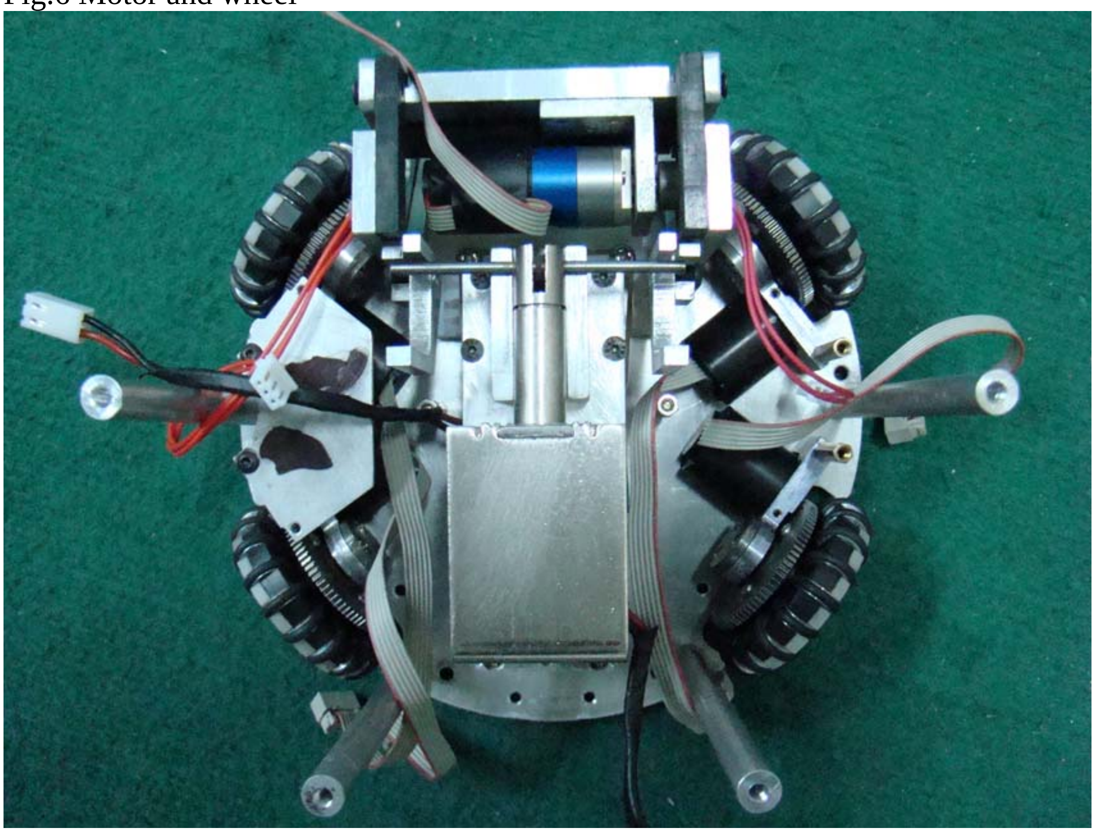

Fig.7 Mechanical design

3) Summary:

The new version of our robot vehicle has been developed and improved over one year. Every member of our team has devoted great effort on this work. We are eager to show our abilities and confidence in the coming competition with satisfaction.