

# The description of team “KIKS”

Keitaro YAMAUCHI<sup>1</sup>, Takamichi YOSHIMOTO<sup>2</sup>, Satoshi HORII<sup>3</sup>, Takeshi CHIKU<sup>4</sup>,

Masato WATANABE<sup>5</sup>, Kazuaki ITOH<sup>6</sup> and Touko SUGIURA<sup>7</sup>

Toyota National College of Technology  
Department of Electrical and Electronic Engineering,  
2-1 Eisei-cho, Toyota, Aichi, 471-8525 Japan

<sup>1</sup>public-class-qoo@ezweb.ne.jp

<sup>2</sup>t\_yoshimoto@hotmail.com

<sup>3</sup>mlb\_moon\_light@inter7.jp

<sup>4</sup>shiketakuchi8836@hotmail.com

<sup>5</sup>masa@toyota-ct.ac.jp

<sup>6</sup>kazu-it@toyota-ct.ac.jp

<sup>7</sup>sugi@toyota-ct.ac.jp

## 1. Introduction

Our purpose of the participation to the RoboCup international competition is to enhance our motivation for development of the creativeness. We think that this competition is the most advanced PBL (project-based learning) experiment. We are aiming the effective education of the creativeness through the robot contest using “MINDSTORMS” of LEGO brocks etc. in our college. The creativity is measured and evaluated quantitatively at many points of view. As the result of education for the creativeness, we found that it was very important to keep neutral position of their knowledge. That is to say, this meaning is important to eliminate no possibilities. We summarize the specific feature of our robot as follows.

- (1) We manufactured the strongest machine which is specialized for the keeper robot using so called “mecanum-wheels” described later.
- (2) Except for the keeper machine, the robots have six drive-wheels.
- (3) We made all machines and electrical circuit ourselves.
- (4) The performance of a camera and a wireless communication system were also raised sufficiently.

## 2. Education of creativity

We have educated the creativity using the robot contest for more than six years. The feature of our college is introduced as following.

- (1) The process for elaborating an idea is a kind of brainstorming. So, the students debate the presentation of each idea by meaning of the tournament method. As the results, the idea is evaluated by many students and improved to the refined idea.
- (2) Each function of various robots can use as the image database to enhance the

efficiency of idea.

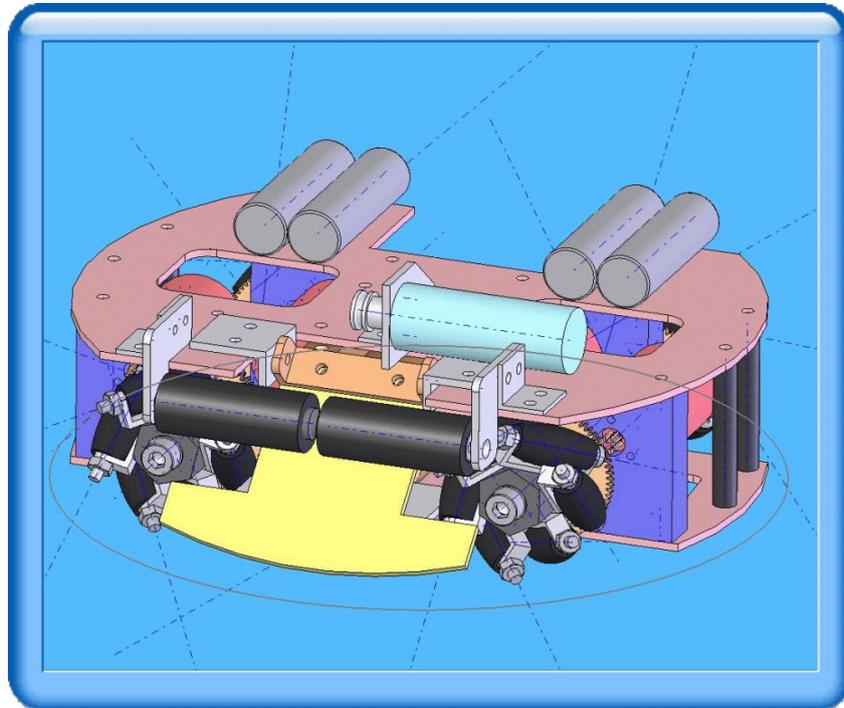
- (3) Our college is well known in Japan as manufacturing an original and a unique robot. KIKS was resulted the 3rd prize of RoboCup Japan Open held in 2004. Moreover, we got the certification for international competition of 2004 and 2005.
- (4) The robot using six drive-wheels was only one in the competition, and our machine was introduced as unique robot in ROBOCON MAGAZINE in Japan.

### **3. Manufacturing of super Robot with “mecanum-wheel”**

Up to now, we have manufactured the robot which does not take into account the position on the field. That is, the robots have the same mechanism and same function for all position. But, in actual soccer game, e.g. the keeper does not necessarily move similar to the other players. The action of a keeper is specializing for the trapping, punching, kicking with quick motion mainly to the transverse direction. Thus, we tried to manufacture the high-performance keeper robot which can shoot loop-kick. In RoboCup international competition, our problem is the lack of shooting ability. Then, we reduce the number of defender robots and increase the number of offense robots. We believe that the ability to get score is getting better than that of last year. In 2006, we produce the keeper robot with so called “mecanum-wheels” and four robots with six drive-wheels. The mecanum-wheel is shown in Fig. 1. The six slack-like pipes are attached at the angle of 45 degree.



**Fig. 1 The mecanum-wheel**



**Fig. 2 The outline of keeper machine**

The mecatronics-wheel is attached to the machine as shown in Fig. 2. For the move of right-and-left direction, it is performed by rotating in the same direction of four wheels. The forward direction is performed when a wheel on either side rotates inside, and backward direction is performed when a wheel on either side rotates outside. The machine is able to move for all direction as mentioned above. A motor using for all mecatronics-wheel is produced in maxon co. The motor is controlled by PID feedback control system which used encoder. Furthermore, a loop-kick is able to do perfectly. As the results, when a keeper clears a ball, a possibility that a ball will hit an enemy's defender becomes low, that is, a possibility of an own goal is getting lower.

#### **4. Wireless communication system**

The wireless communication system was changed into “Futaba FRH-SD07T”. The old communication system was weak to interference, and its radio attainment distance was very short. Even if the robot operated sufficiently in our laboratory, it might be impossible at the end of the competition field. Moreover, since the transmission speed of the communication was slow at old system, we had to prepare three transmitter and 3 bands of frequency. This cause complicated problem such as a setup of ports and software program. At present, the transmission speed of new communication system is improved by 3 times. It is used one transmitter. The various problems were solved mentioned above.

## 5. Image-processing system

Up to last year, the image-processing system was used one camera system. We changed into two cameras system by “BASLER A310fc” as shown in Fig.3. Since it was interlace scanning system at old system, it was very difficult to catch a ball moving with high speed. However, now we can recognize it perfectly, because of change into the progressive camera system. Moreover, the frame rate of a camera is also changed into 73fps from 30fps. As the results, we are able to catch the object precisely more than twice compared with that of old system. Furthermore, the camera system with NTSC format and capture board is not convenient against carrying of system. The desktop PC was also needed. Then, we constructed the new system using the notebook PC with the IEEE1394 terminal. As the results, the external capture board is unnecessary and the carrying of system became easy.

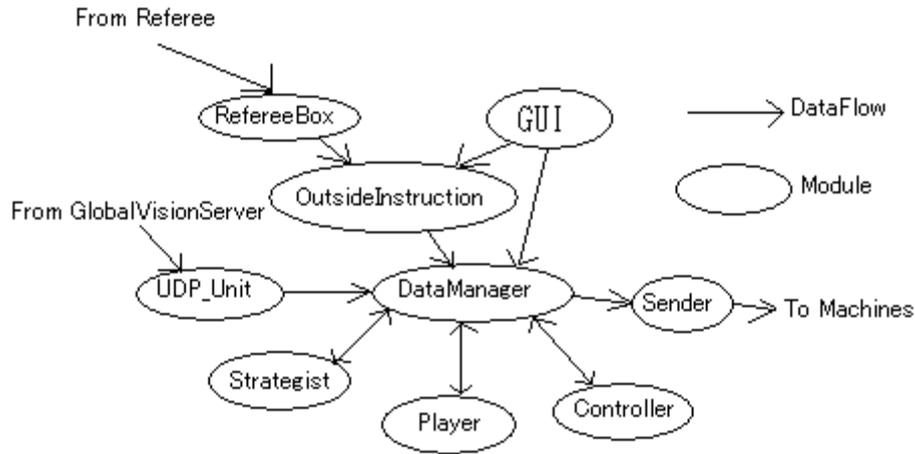


Fig. 3 BASLER A310fc

## 6. Artificial Intelligence program

Artificial Intelligence (AI) program was renewed for all. Up to last year, the program which played strategy role include for the most of part. Therefore, there was no extendibility. Thus, we separated the strategy program from other functional part, and reconstructed the system which can easily change the strategy part.

Many data received from referee box and/or global vision server are sent to “data manager”. The command analyzed by “data manager” is sending to and receiving from player, strategist and controller. Finally, the results is sent to the machine. The procedure is shown in Fig. 4.



**Fig. 4 Relationship and configuration of each module**

## 7. Conclusion

We have done the most of improvement for all part. As the results, we got the high performance for the robots and AI program, compared with that of last year. It is expected that our machine achieve the first “goal”. We want to demonstrate the performance and the motion of our robots in the competition. We summarize the specific feature of our robot as follows.

- (1) We manufactured the strongest machine which is specialized for the keeper robot using “mecanum-wheels”.
- (2) Except for the keeper machine, the robots have six drive-wheels.
- (3) We made all machines and electrical circuit ourselves.
- (4) The performance of a camera and a wireless communication system were also enhanced sufficiently.

Furthermore, to participate to the RoboCup International competition, it is very important for us to keep the motivation for the development of the creativity. The quantitative measurements and evaluation of the efficiency about education of the creativity is difficult. Especially, sufficient analysis of that effect is not able to do for a short period. That is to say, we need such situation which is highly kept the motivation for a long period. The college and/or institute in Japan where can educate continuously the creativity for the students of 16-20 years old are scarce. But, we can do that for a long period. In order to investigate the students’ ability for development of creativity, we think that it is important to continue participating to the international competition.