

1 The description of team “KIKS”

The description of team “KIKS”

Keitaro YAMAUCHI¹, Takamichi YOSHIMOTO², Satoshi HORII³, Takeshi CHIKU⁴,
Masato WATANABE⁵, Kazuaki ITOH⁶ and Toko SUGIURA⁷

Toyota National College of Technology
Department of Electrical and Electronic Engineering,
2-1 Eisei-cho, Toyota Aichi, 471-0067 Japan

¹e70339@toyota-ct.ac.jp

²e70342@toyota-ct.ac.jp

³e70334@toyota-ct.ac.jp

⁴e70324@toyota-ct.ac.jp

⁵masa@toyota-ct.ac.jp

⁶kazu-it@toyota-ct.ac.jp

⁷sugi@toyota-ct.ac.jp

1. Introduction

Main purpose of our participation to the RoboCup world competition is confirmation of the result of the PBL (Project Based Learning) experiment. Our team (KIKS) has participated for four years since 2004. In 2007, it was resulted in one of the BEST8 teams. We have educated for the creative minds of students using the robot contest held in our department of electrical and electronic engineering. The creative minds have been evaluated quantitatively using the examination of the creativity or the personality test continuously.

2. Education of the creative minds

We require to the students that to turn in the robot idea term paper about domestic robot contests, RoboCup competition and PBL experiment in our college. In recent years, the idea sketches drawn by students are getting worse at the point of non-reality and childish imagination etc. Especially, expression's ability of figure is declining remarkably. We think that the reason as following. That is, previous students are called in TV generation and/or portable game generation. We think that they have much input of the 2-dimensional data from television etc. On the other hand, the input of actual 3-dimensional data (basic space form proved biologically and in engineering) is scarce.

The creative minds are not produced from nothing, but are born from the combination and/or arrangement of past data, new point of view and motivation etc. That is, an accumulation and/or a collection of the data arranged by many points of view are very important to enhance the creative mind.

We have studied about the educational method to develop the creativity using the robot contest. In the case of our college, the feature is described as following. The

2 The description of team “KIKS”

making process of an idea is a kind of brainstorming. So, the students debate the presentation of each idea by meaning of tournament. As the results, the idea is evaluated by many students and improved to the refined idea. Each function of various robots can use as the image database to enhance the efficiency of idea.

Moreover, in this year, we try to execute a method to improve an ability of originality and creativity by using the 3-D model. Figure 1 show the example of 3-D model. The example of report drawn by student is shown in Fig.2. Now, we investigate and evaluate about that. So, we will leave the details of the result to another opportunity.



Fig.1 Example of 3-D model

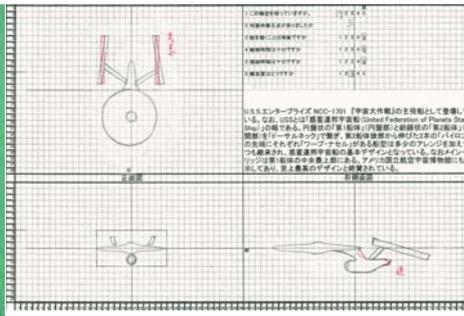


Fig.2 Example of report drawn by student

3. Robot

KIKS is constructed with four conventional robots which can move for all direction and keeper robot with special wheels. The standard robot has powerful straight kick device (maximum ball speed of 9.5[m/s]) including the chip kick device. And it has maximum robot speed of 2.5 [m/s] for all directional motion using by Re-max24 of MAXON made.

A special wheel called mechanum wheel is used in the keeper robot. The mechanum wheel is specialized to the motion of the right and left direction. Therefore, keeper robot can move faster than other robots on that direction, and keep out the ball using the powerful chip kick device.

We made the apparatus to measure the ball speed, and evaluated quantitatively the performance of solenoid for chip kick device. The results are shown in Fig .3. The mechanical reliability of robot was improved by strengthening an overall structure.

The communication mode of a wireless device was changed and the program of that system was improved similarly. As the results, it was able to communicate the sixty times per second to AI system.

The extended Hamming code is introduced for the error correction. Then, the communication error is able to detect within 2 bit error.

The motor driver's circuit is manufactured ourselves. It includes a CPU for each wheel. Therefore, the feedback control can be performed without any load in main CPU.

3 The description of team “KIKS”

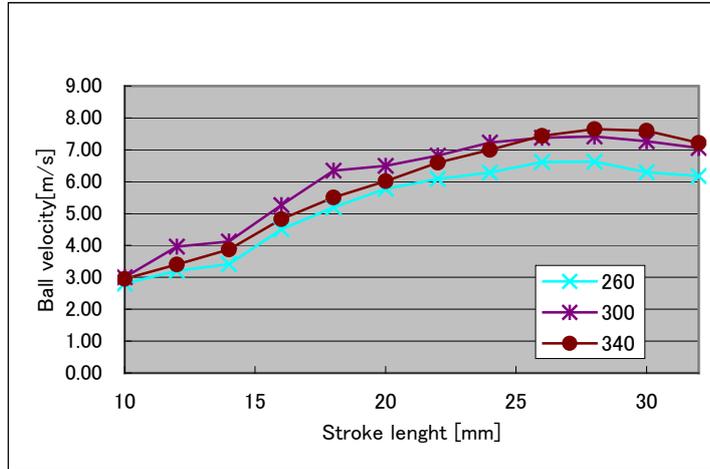


Fig.3 Evaluation of solenoid performance for chip kick

In our previous circuit for kick device, the voltage range of a capacitor was maintained between 170[V] and 200[V]. In that case, if the robot kicks the ball continuously, the big difference of ball speed is occurred in proportion as the remaining voltage of a capacitor. Figure 4 shows the ball speed to the number of times for kicks. In Fig.4, the symbol marks are meaning of the parameter of gate on time of MOSFET between 1.4 [msec] and 3.5[msec], respectively. The solid line is corresponding to the present circuit, and broken line corresponds to the previous circuit. In the present circuit of Fig.4, the voltage range of a capacitor was kept between 190[V] and 200[V]. As the results, the fluctuation of pass speed is decreased remarkably.

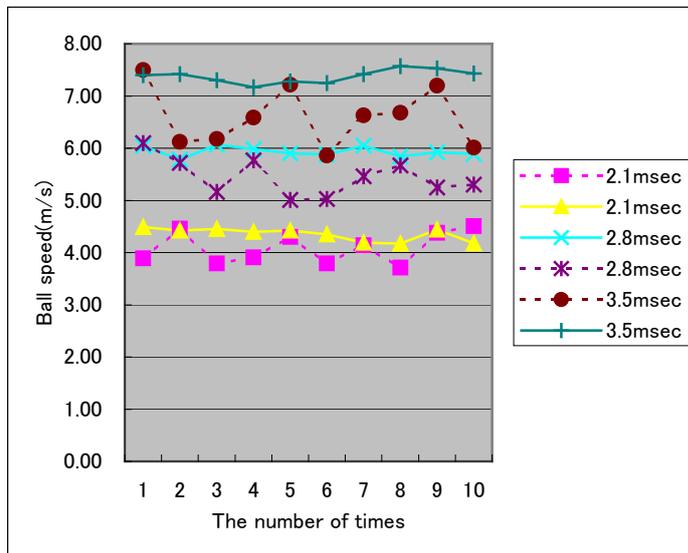


Fig.4 Dependence of the ball speed as a function of a number of times.

4 The description of team “KIKS”

4. Image-Processing System

Now we use the two cameras as the global vision system, but their cameras do not synchronize. Thus, the waiting or waste time was occurred at the time of combination of the image information from two or more cameras. Therefore, this delay time had a serious influence on the whole of system. Moreover, this problem will be more serious as increasing the number of cameras.

Then, we redesigned the system that could correspond to two or more cameras. It could be synchronize all cameras using by UDP protocol.

5. AI System

Up to now, we, KIKS did not have used a simulator in AI system, but the development for AI system has been performed only for debugging. But, as complicating of strategy, it will be very important to use the simulator for development. Then, in this year, we develop the new AI system incorporating simulator. As the results, it was able to do the development of strategy easier compared with previous system. The image of simulator is shown in Fig.5.

In the simulator, each robot's character can be input. Therefore, it is able to simulate more realistic strategy.

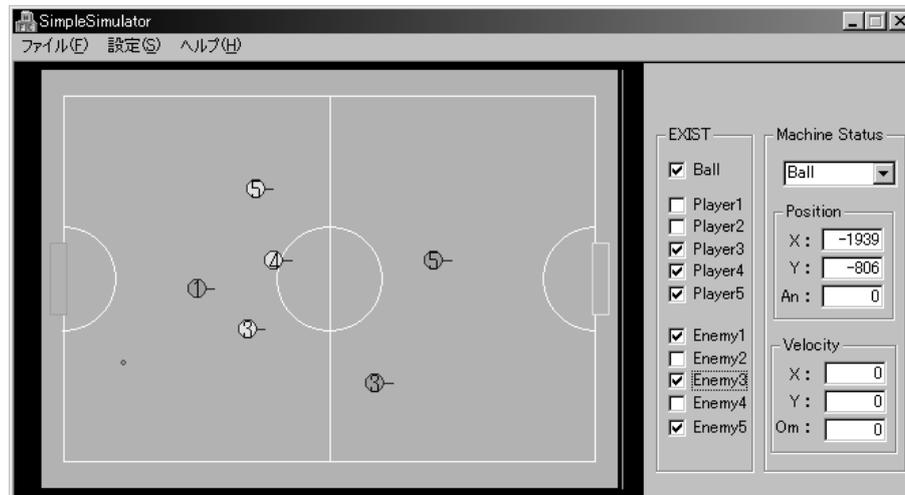


Fig.5 The image of simulator for RoboCup

6. Control unit

In previous system, the delay time in control of a machine has occurred by the time-lag related to the calculation time of AI server, image server and transmitter. To solve this point, we carried out the linear prediction for the output data to a machine. As the results, we could achieve more correct control for positioning.

7. Conclusion

We have done the improvement for all parts. As the results, we got the higher performance compared with the last year. Most of devices are hand made by students. Thus, the cost performance is very high in fact. Moreover, we are confident in saying that our education of the creativity makes to result the development of this system with student members of fewer than 20 years old.

As further creative education, we think that to enhance an ability to recognize 3-D space image for students of electrical and electronic engineering. In the investigation of this year, we found that the ability to recognize 3-D space for students belong to electrical and electronic engineering was very low. One of the reasons for mentioned above that there is very little subject for drafting or CAD in a curriculum in that department.

We have a plan to investigate the degree of that characteristic in wide range in near future.