A New Robot Design for Martial Arts Arena Simulation

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***Abstract* — In order to improve the success rate of martial arts simulation robots, we propose the design of a new algorithm. The algorithm reflects the essence of intelligent robot automatic control of being steady, accurate and fast to ensure a higher success rate. In addition in this paper we also introduce the martial arts challenge Microsoft simulation platform installation and Visual Studio programming software.**

Keywords - Martial simulation robot, Microsoft Visual Studio, Algorithm design, Block diagram.

I. INTRODUCTION

Stability is one of the important properties of intelligent robots, which also is a prerequisite for a robot working properly. The Martial robot simulation's gravity is higher. If the speed of the robot change too fast or suddenly impacted by enemy, the robot would be extremely easy to fall. In this paper, we have studied the achieving of the intelligent PID control algorithm[1] and the different types of PID parameter tuning methods[2]. And we used the PID algorithm and analysis the processing of a variety of special situations to increase the stability of the robot. How to improve its offensive in maintaining the stability of the robot, which is one researcher should pay attention to when he is designing the algorithm.

When the game start, the robot should rapidly reach the center and make a favorable position.[3] According to find opponents, close to the opponent, hit the opponent, run away and occupy a central location such as actions to design algorithms[4], whose structure is relatively simple, but it lacks the edge treatment. In the martial arts arena race, if you have a good edge processing program, which can let the robot be converted from a disadvantage position to a advantage position and far away from the edge.

Setting an edge determination value (such as 30cm from the edge), and after the robot location reaching the edge of this valve, accumulated state. If the robot achieves the accumulated state value (a certain time), the side robot decelerate, stop and move toward the center to the edge of handle[5], but generally the robot is no reason to move to the edge. Either the enemy is pushing or being pushed by enemy, so the robot slow down and stop which is unreasonable. This algorithm though analyze a variety of special situations and effectively dodge, rotate and point movement to make the robot away from the edge of the square and make the enemy robots closer to the edge at the same time . This article is not only relatively high success rate but also can help players quickly access to the code design and build his own ideas and action functions.

II. MICROSOFT VISUAL STUDIO

Microsoft Visual Studio (abbreviated VS) is a US Microsoft Developer Kit series. VS is a basic full set of development tools, which includes most of the tools throughout the software life cycle needs, such as UML tools, code management and control tools, integrated development environment (IDE), and so on. Object code written for all platforms which supported by Microsoft, including Microsoft Windows, Windows Mobile, Windows CE, .NET Framework, .NET Compact Framework and Windows Phone. Visual Studio is the most popular Windows-platform application development environment which has a powerful debugging capabilities and especially for IE browser Ajax debugging.

Visual Studio enables users through a wide variety of programming languages developed. Native support for Visual Studio 2010: Visual Basic, Visual C #, Visual C ++, Visual F # four kinds of programming languages. C # is simple, powerful, type-safe, and it is object-oriented. With its many innovations, it achieve a rapid application development while maintaining a C-style language representation and beautiful. The Microsoft martial arts arena simulation decision-making process are written in this language, and then generate the .dll file to import simulation platform. Every year, there is a new version adds some new features in Visual Studio. VS2012 system resource consumption is not large, but it needs the support of Windows 7/8.

III PLATFORM TO BUILD

A. Microsoft martial arts arena simulation game platform (WushuRoboitcs3)

The platform was based on Microsoft Robotic Studio (MSRS). Microsoft Robotic Studio is a variety of robot hardware platforms to support Windows development environment and supports .NET Framework .NET Framework and streamlined at the same time.

B. PhysX_7.11.13_SystemSoftware

PhysX is a physics engine which is set by performing complex calculations AGEIA physics design. It not only can be calculated by the CPU but also can be calculated by called independent floating point processors (Such as GPU and PPU), so that it can be easily done as fluid dynamics simulation physics simulation as large as computational calculations.

C. directx_jun2008

Microsoft hardware programming interface, which contains several components, such as Direct Graphics (Direct 3D + Direct Draw), Direct Input, Direct Play, Direct Sound, Direct Show, Direct Setup, Direct Media Objects and also provide a set of multimedia interface Solutions

IV.ALGORITHM DESIGN

A. Acquisition and processing of information platform

(1) Simulation environment will return their robot head camera captured images, and you can get the other location and distance from the edge of the image processing calculations. (2) There are 17 robots torso laser rangefinder, and you can use this to know the distance from the enemy's distance and position. (3) Simulation environment has elapsed game time by a timer recording. The initial value is zero, and every 40 milliseconds plus one. Each game time is 40 seconds. (4) Simulation environment return the enemy's and side robot posture ,and the sequence is x, y, z, but simulation environment does not provide this coordinates in the real race, so you should observe the information to identify the location of the pitch derived by the opponent and the other robot robotic camera head. (5) Simulation environment also return the side robot left and right wheel speed.

B. Composition Challenge robot action

The arena robot's sports consist of going back, rotating, going forward, swing arm and other basic actions。Based on the combination of these basic actions and the side robot can have arm attacks, curves impact, rotate dodge and other complex actions. From these actions, the side robot can effectively attack the enemy.

C. algorithm ideas

(1) Program consists of: the design of the code section consisting by the main program, the last time program, the handler edge program and adversarial process program. (2) The main program contains an internal target discovery program and close to the target program. The robot simulation martial high 30cm, long 20cm, wide 15cm, arm long 20cm, and the gravity of robot is higher, when the robot speed change too fast or suddenly impacted by enemy and the side robot are very easy to fall. So the robot should be taken at steady speeds to near the enemy. (3) The last time processing program: the game-winning rule is: (a) during the game, if one of the upper body contact the ring (lying on the ground) or fall ring, The calculated time of 5 seconds, in this 5 seconds, if the other does not appear the above two cases. The other wins, otherwise credited draw. (b) If the time end and both robots have not fallen or falling ring, then the robot who is closer to the center of the ring wins. So when the two sides are evenly

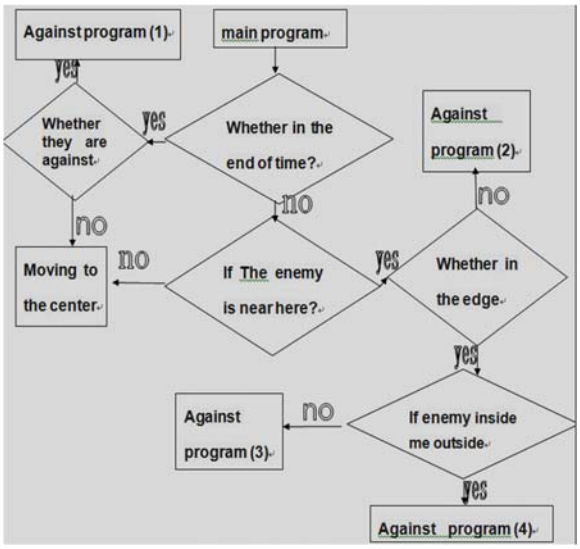

Figure 1 Block Diagram algorithm

matched, this treatment is very necessary. You can use the calculator to set a timer value, when it reaches this time, perform the appropriate procedure (for example the two sides are fighting, both sides can calculate the robot distance from the center. If the side robot is in a same circle with the enemy, then curb the enemy while moving towards the center. If the enemy is more far away from the center, the robot is in a good position, which should keep each other containment. Conversely if the enemy is closer to the center, the side robot can increases the speed of rotation to drive the enemy or rotates itself. (4) Edge processing program: if two sides are fighting again and the side robot reached the set value (for example, from the edge 30cm), judge who is closer to the center. If the enemy is closer to the side robot, the state number begin accumulate. If the state number achieves the certain value, you can dodge a point or increase the speed to against the enemy. If the enemy is more far away from the center, which indicate that the side robot is pushing the enemy robots to the edge, so the robot should not slow down and you can set a secondary edge (such as distance edge 12cm) and assurance the enemy wheels just fell off the ring, which can't travel properly. Then let the robot slow down and move to the center. (5)Against the main program:(a) compare the enemy's speed with the side speed, if the enemy's speed is larger and the side robot can dodge though rotating or retreating so that the side robot can avoid frontal impact. You can retreat to advance.,(b) And we can use tilt angle and tilt angle of the enemy side to properly accelerate and decelerate for effective impact.

D. Block Diagram algorithm

Block Diagram algorithm so as figure 1.

E. debugging techniques and some special case

1) the starting position of the robot

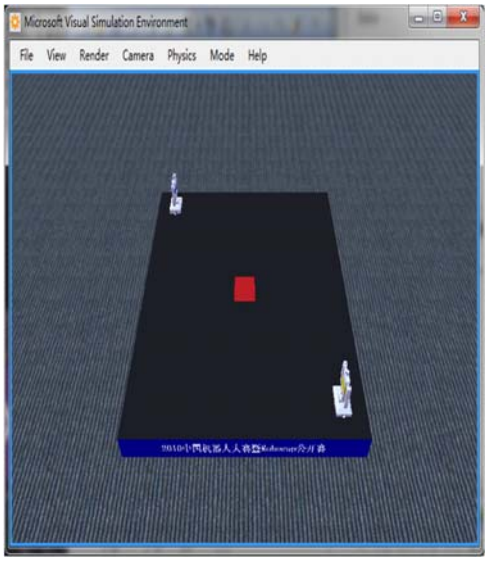

Figure 2 the starting position of the robot

In the beginning, the robot should be smooth and quick movement to the center so that it can occupy a favorable position.

2) When we write the program we must have clear ideas for the program. Through observing the ring robot parameters at some time (such as left and right wheel speed) can help us verify the actual preparation of the program whether it is consistent with our own ideas which let us easy to improve program or deal with certain special conditions.

Let the window displays the current value of certain programming

```
publicvoid OutputInfor()
{
Console.WriteLine("Right wheel speed");
Console.WriteLine(_rightWheelSpeed);
```

```
Console.WriteLine("left wheel speed);
Console.WriteLine(_leftWheelSpeed);
Console.WriteLine("Sensor test distance r");
Console.WriteLine(r);
Console.WriteLine("Enemy distance d");
Console.WriteLine(d);
Console.WriteLine("Robot angle between the upper body");
Console.WriteLine(_wushuEnv.robotRotation[0]);
// Console.WriteLine("Robotics and sideways angle");
//Console.WriteLine(_wushuEnv.robotRotation[2]);
// Console.WriteLine("2 robot angle between the upper body");
//Console.WriteLine(_wushuEnv.opponentRotation[0]) ;
}
```

Figure 3 is display window

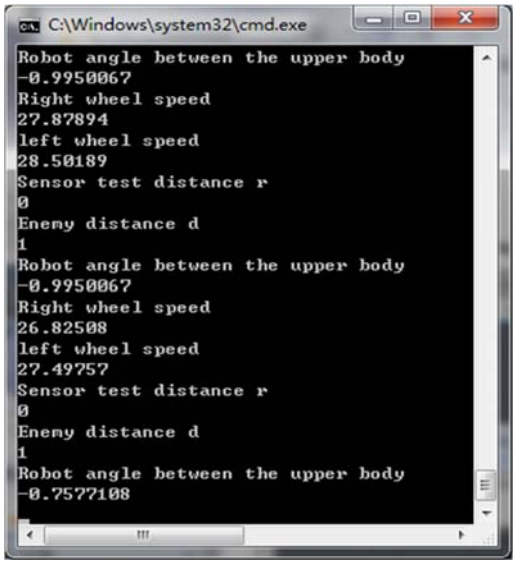

Figure3 display window

Figure 4 is corresponding current platform image

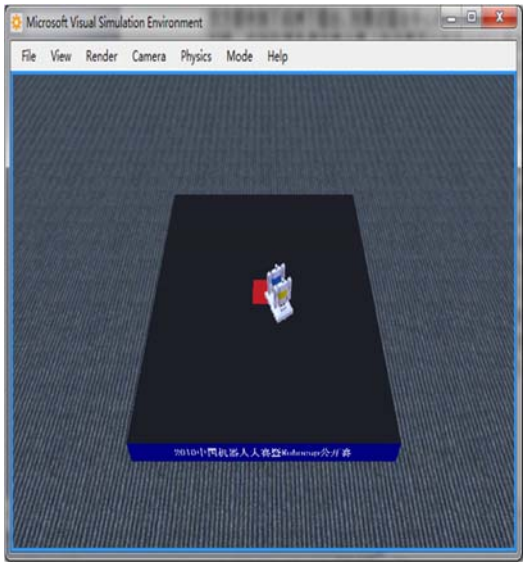

Figure 4 current platform image

3) Marginal issue

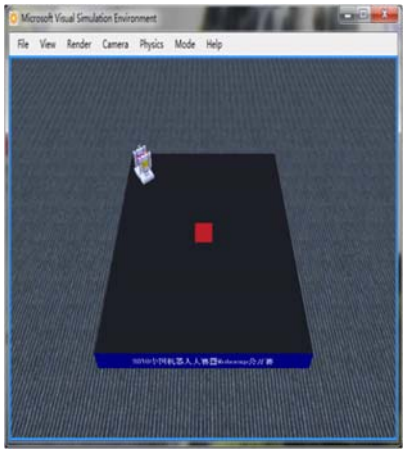

Figure 5 the enemy to the edge

Figure 5 the robot is pushing the enemy to the edge, and you can keep the curb each other, but the speed is not too large.

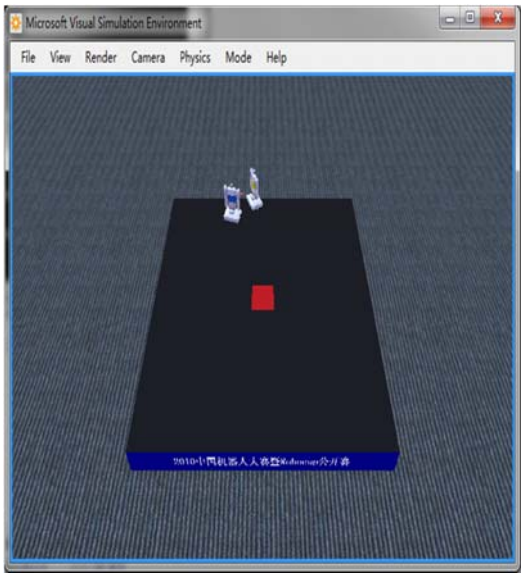

Figure 6 the enemy's wheels vacant

Figure 6 the enemy's wheels vacant and it unable to run normally, so the side robot can move to the center or push the enemy under the ring by using the point movement.

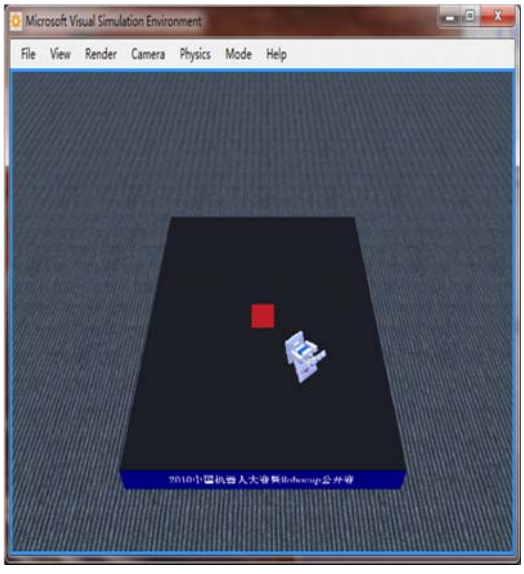

Figure 7 both sides of the wheel vacant

In the fierce fighting, the two sides often appear the figure 7 situation - both sides of the wheel vacant and they can't move, and you can judge the attitude of the two sides and flexible use of the arms to attack the enemy.

V. SIMULATION RESULTS

In the official website, we can download the .ll file which was written by Microsoft Corporation. Here we take more confrontational and stability of the fourth A4_cslg.dll file and the fifth A5.AHU.dll file to compare.

TABLE 1 .DOWNLOAD A4_CSLG.DLL FILE CONFRONTATION RESULTS

Algorithm	Administration Number	Victory	Draw	Negative	Wins
no finally time treatment	300	197	65	38	65.7%
No edge treatment	300	139	86	75	46.3%
Reference algorithm	300	145	79	76	48. 3%
This article	300	209	63	28	69.7%

TABLE 2 DOWNLOAD A5.AHU.DLL FILE CONFRONTATION RESULTS

Algorithm	Administration Number	Victory	Draw	Negative	Wins
no finally time treatment	300	192	64	44	64%
No edge treatment	300	143	98	59	47.7%
Reference algorithm	300	152	85	63	50.7%
This article	300	224	46	30	74.7%

VI. CONCLUSIONS

Martial arts contest include motor learning, signal processing, automatic control theory, computer software technology and other subjects content, and it also is an important platform for intelligent robot research. With the rapid development of microelectronics technology, computer technology and network technology, the robotics technology also has been rapid development. Applications of intelligent robots are also expanding. Its species are increasing and its performance continues to improve. In order to facilitate our research and learning intelligent robot, researching and developing the robot simulation technology is particularly

important. I has participated in the 2014 National Robotics Competition and Robot Cup Open the Microsoft Robotics Challenge martial arts simulation game and this paper was written by combining the advantages of the various teams and the existing literature.

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