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The motion editor and high precision integration for optimal control of robot manipulators in dynamic structural systems

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Abstract. The paper presents the motion editor for the robotic movement in the study. The Motion Editor can edit all motions which we want to need. This method is easy when the beginners edit to motions of robots. And let them have interesting in robot control. This paper proposes two methods to edit movements. First, we edit the robot's movement in VB environment, and then we use the Motion Editor to make it. Finally, we compared merit and defect with two methods. Indeed, it is convenient when we use the Motion Editor.

Keywords: biped robot; displacement; dynamics; intelligent robot; artificial intelligence

1. Introduction

As the robotics domain advance, robots are being hired in increasingly complex and demanding job. To perform a given job, a robot accumulates or receives sensory data about its external environment and takes actions within the changing environment and information (Goto *et al.* 2008). The ultimate goals of mobile robotics research is enable the robot with high autonomous ability so as to improve the actions over time based on the incoming experience (Abe *et al.* 2007). The behavior-based robotic approach is based on the ideas of providing the robot with a commutation of uncomplicated essential behaviors (Ozeebe and Saateioglu 1987).

Sound source tracking and analyze have complex and difficult job, because the robots to approach target difficult to recognize from a far location. Approaching the target using auditory sensors enables the use of visual sensors for detail identification (Morshed and Kazemi 2005, Koike *et al.* 2007, Grispim *et al.* 2008, Li *et al.* 2008, Su *et al.* 2008).

For finding the similarity of audiovisual episodes by handle an object. Uses the common grouping

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rules in Gestalt psychology, that is, "simultaneity" and "resemblance" among movement command, sound beginning, and movement of the objects in images (Sheikh and Uzumeri 1982, Kent and Park 1971). And local obstacle avoidance is a rule ability for movable robot in unfamiliar or partially recognizable environment. We can find a new obstacle avoidance come near which associates the prophecy model of collision with the improvement BCM. In sound localization ear, fuzzy artificial neural networks and a generic set of head related transfer functions which the method we use. Due to fuzzy logic, the technique d is able to interpolate at output, orientation with high accurateness sound source at location that were not used for practice (Hsiao *et al.* 2005a, b, c, d, e, Hsieh *et al.* 2006, Tsai *et al.* 2008, Yang *et al.* 2008a, b, Yeh *et al.* 2008, Almutairi and Zribi 2009, Amini and Vahdani 2009, Lin *et al.* 2009a, b, 2010c), even in existence of environment which is strong deformation. Sometimes, we think use microphone to sound localization or obstacle avoidance. Nevertheless, when a usual microphone array is set up a system, such as a machine, car or robots, the microphones are set unusually near the system's real body (Guclu and Metin 2009, Lin and Chao 2009, Omurlu *et al.* 2009, Tu *et al.* 2009, Tusset *et al.* 2009, Zhao *et al.* 2009, Lin 2010, Chen and Saif 2010, Lee 2010, Lee *et al.* 2010a, b, Li *et al.* 2010, Solihin *et al.* 2010, Lee *et al.* 2011a, b, c, Chiang *et al.* 2010, Shih *et al.* 2010a, b, c, Chiang and Wang 2011, Cheng *et al.* 2011, Chu *et al.* 2011).

In some cases, the noise usually come from the system itself. For example, motors, gears, and engines, that is interior noise, often becomes a bothersome problem. Mitsuharu Matsumoto present the method (Chiou *et al.* 2011, Shih *et al.* 2011a, b, c, d, e, f, g, Kuo *et al.* 2011, Kuo 2011, Lin 2011, Liu *et al.* 2011a, b, Lin *et al.* 2011a, b, Jayaswal *et al.* 2011, Marichal *et al.* 2011), a general depiction of the acoustical array is define and the representative traits of microphones and piezoelectric tools in an acoustical array are given. Sensor fusion is one of the clue technologies for understand robotic systems. Because sound is unidirectional and can be detect in dark or unknown environments, mixing the auditory sensor with others, such as visual sensors, will supply effective identification of the robot's working environment. Many studies have inspected sound source tracking and localization . Webb built an auditory sensor system based on the neural control and cricket ear (Metin and Guclu 2011, Soundarrajan and Sumathi 2011, Shen *et al.* 2011, Tang *et al.* 2011, Tsai 2011a, b, Yu *et al.* 2011a, b, Kuo 2012a, b, Lee, 2012, Lin *et al.* 2012a, b, Lin 2012). Faller and Merimaa proposed a method which sound source localization based on interaural cohesion for complicated listening situations where reflections and superposition influence of concurrently reach sound are considered. Murray *et al*. proposed a mongrel system combining cross-correlation and recurrent neural network for robot sound source tracing. Woo-han *et al*. presented a way for impulse (footfall) sound source tracking using Kalman filter. Because unlike sensor melt may give effective distinguish ability of environment, combinatorial use of visual sensors and auditory for sound localization is also studied. Much research has been guided on obstacle avoidance in robots. The dynamic window method is one of the best method that can take into account the non homonymic limit and be applied to unfamiliar environments. In this method, the goal of the mobile robot is given and the robot movement is usually resolute to optimize a sure price operate, for example the distance to the goal. In this sound source tracing problem, the path from which the sound comes changes with refer to the block conditions, and therefore the obstacle avoidance method should be consider what the sound comes changes quickly. There are some researches on sound source tracking with an obstacle avoidance operate for robots. Huang *et al*. proposed a real time sound localization system for a mobile robot prepare sonar system and three microphones for obstacle avoidance. Tseng *et al.* (2012) presented an attractor dynamics method to phonotaxis of a robot with seven infrared sensors and five microphones. Depends on diffraction about a human's head model with only two microphones that Andersson *et al.* developed a phonotaxis system. Although, robot dynamic is not considered in the methods. In addition, the validity of the researches is not debated from the positional analyses and steady viewpoint (Liu *et al.* 2012a, b, Su *et al.* 2012, Tseng 2012, Tseng *et al.* 2012a, b, c, Yeh *et al.* 2012).

In the paper, we offered to use infrared distance sensors and Ultrasonic sensor to perform obstacle avoidance. The proposed way can reduce to detect distance which sometimes could be result error. Though obstacle avoidance is an essential ability for robots, but it has to considered other possibility. Because a few obstacles disturb not only the robot's movement but also the passage of sound, these two functions should be considered simultaneously in the robots controller. Nevertheless, this paper put the function by which the passage of sound. The paper is organized as follows. Section 2 presents the robot how to install and what parts we need. Section 3 introduces how can we do to let the robot running and dance. Section 4 show our results. Finally, conclusions are in Section 5.

2. Install

In the Table 1, we can know thestructure is composed of 12-DOF Bipedinno, and it can move or dance by Servo and 12 Bearing which were curved.

The 12-DOF Bipedinno is made up of two areas.

1. The down part is joint area :

Make up Aluminum Servo Bracket, Aluminum U-shape Bracket, Aluminum Foot Bracket by next picture (Fig. 1). Lastly, Put the Servo into Bracket.

2. The upper part is controlling panel area :

Controlling panel area is configure BC1, Servo Runner A, Command Board, and Servo Power

Table 1 Component list

Main Board for installing module	1
Top Board for installing module	1
Aluminum Foot Bracket	2
Aluminum Servo Bracket	12
Aluminum U-shape Bracket, 27 mm	4
Aluminum U-shape Bracket, 22 mm	8
Servo	12
Screw A ISOT 3 × 8 mm	48
Screw B ISOP 3 × 6 mm	10
Screw C ISOP 3 × 10 mm	20
Screw D ISOP 2 × 5 mm	32
Screw E TP1P 2 × 6 mm	40
Screw F TP1P 2 × 8 mm	8
Screw G ISOF 3 × 6 mm	4
Screw H ISOF 2 × 5 mm	8

Table 1 Continued

Nut A 3 × 5 mm	90
Nut B 2 × 4 mm	32
Washer A 3 × 0.4 × 8 mm	72
Washer B 3 × 1 × 6 mm	12
Bearing 3 × 4 × 8 × 9.5 mm	12
Hex post, copper 30 mm	4
BC1	1
Servo Runner A	1
Command Board	1
Servo Power Line	1
Command Board Power Line	1
cmdBUS™	1
Servo Extension Cable	4
USB cable	1
Cable Strap	12

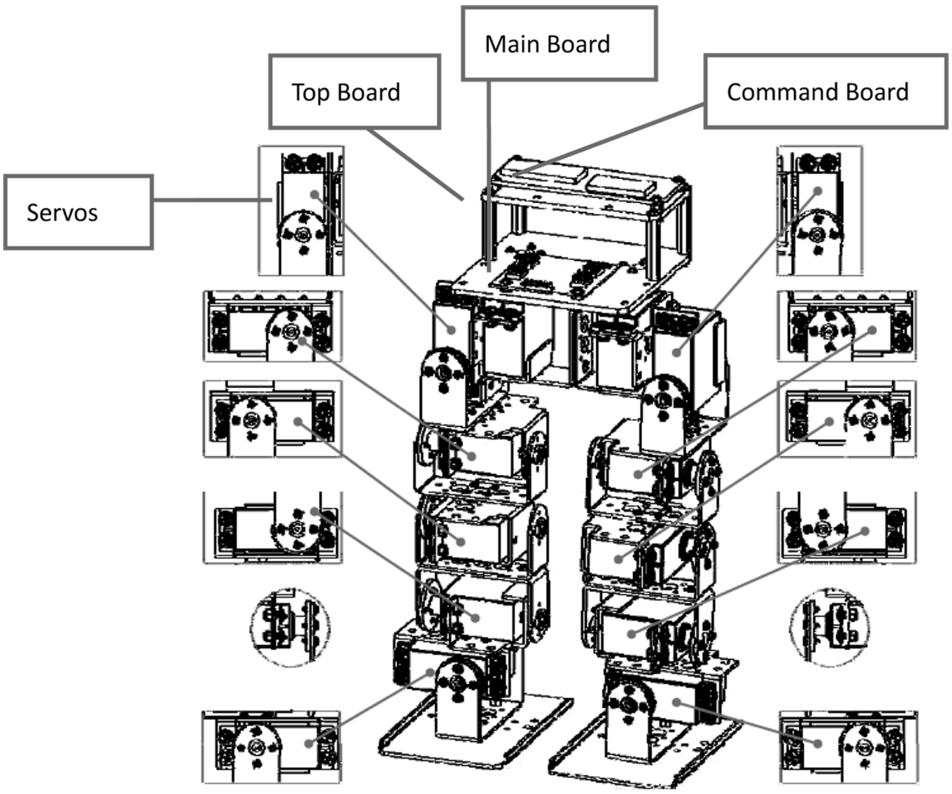

Fig. 1 The down part is joint area

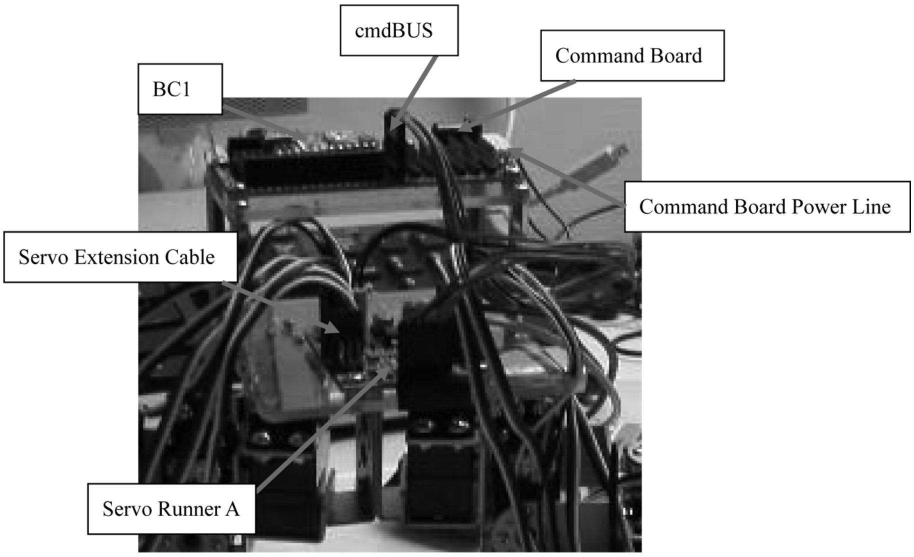

Fig. 2 The upper part is controlling panel area

Table 2 Comparison merit and defect with two methods

	Complete speed	Difficulty level for beginner	Difficulty level for correct movements	Fineness movement level
Motion Editor	Fast	Easy	Easy	Bad
VB Program	Slow	Hard	Hard	Good

Line, Command Board Power Line, cmdBUS, Servo Extension Cable are directed controlling panel to control 12 Servo (refer to the Fig. 2 how to wiring). Finally, use USB cable to connect with my computer.

3. Program

We use Motion Editor to cut the movements which are changed into several seconds in two minutes. Let us do net need to find program to correct movements.

Through the Table 2 above, we can know that Motion Editor is for beginners to learn easily and the process is also simple. But, movements aren't fluent and all Servo can also delay for message changed.

1. In Motion Editor, we use Time and Speed buttons(the buttons refer to Fig. 3(a)) to set the perform speed in all Servo.Or, in playing (Fig. 3(b)), we set more delay time when the motion don't perform finally. But, the method mentioned above can cause more time to perform a movement.

2. In linking all of the movements, we observe and write records to carefully adjust after performing the program, yet we still have to adjust many problems of action again. As a result, we rise up the solution to solve the problem mentioned above. When we use Time and Speed buttons to set (Fig. 3(a)), this problem occurs not so often as before.

Fig. 3(a) How to edit the movement in Motion Editor and we use the time and speed buttons

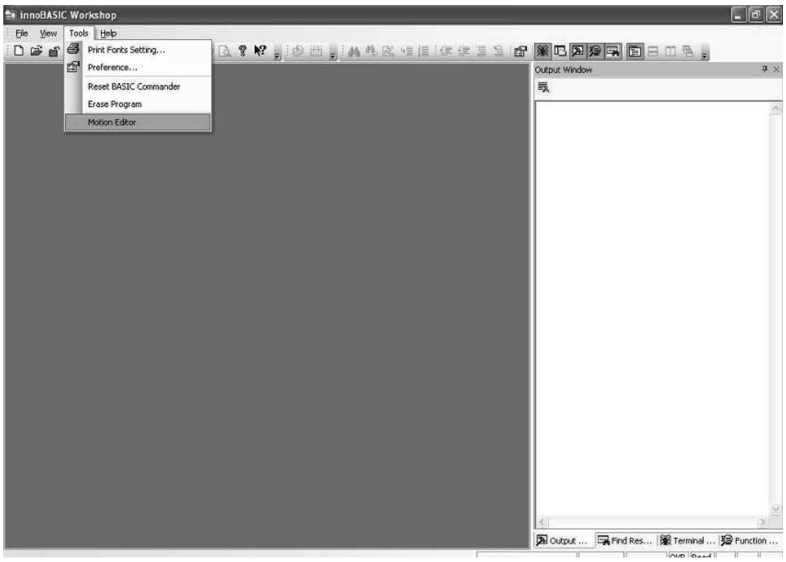

Fig. 3(b) Playing all the movements of robot when we need to perform we set the program which it edits finally in Motion Editor

3. When we edit the movement, we use power to supply. However, when we are going to perform a movement, we use batteries to supply.

From the picture (Fig. 4) above, we can understand the fact that when we are editing programs or motions in Motion Editor, we could write BC1 which is the RAM through USB cable. And use Command Board and cmdBUS to link Servo Runner A of Servo to deliver the messages. Finally, we connect 12 Servo Extension Cable of Servo to control the running of our robot.

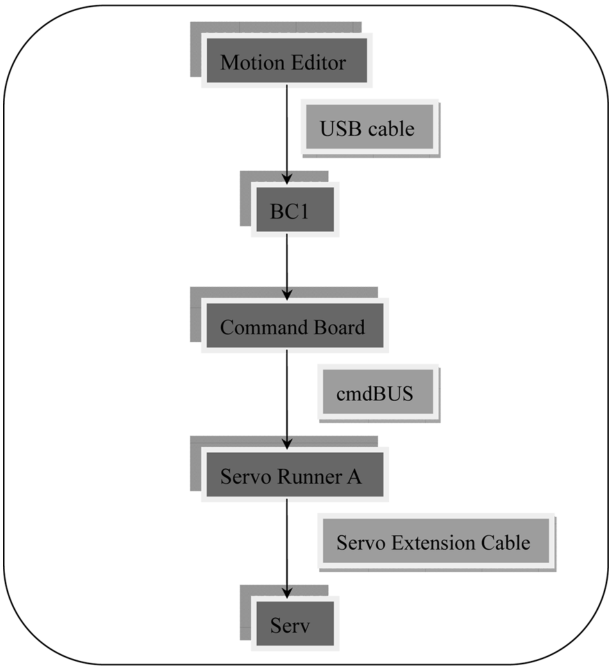

Fig. 4 This is flow chart which the program performs the movements on 12-DOF Bipedinno robot

Fig. 5 We want to robot that can do the motion

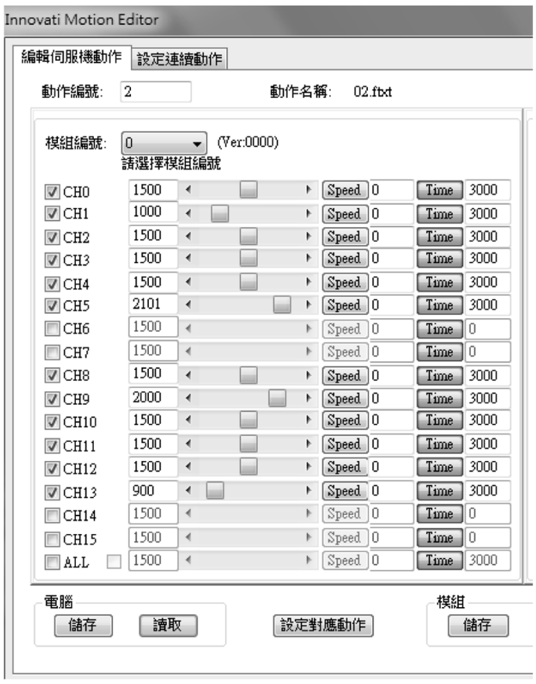

Fig. 6 Number in Motion Editor when the robot stands up slowly

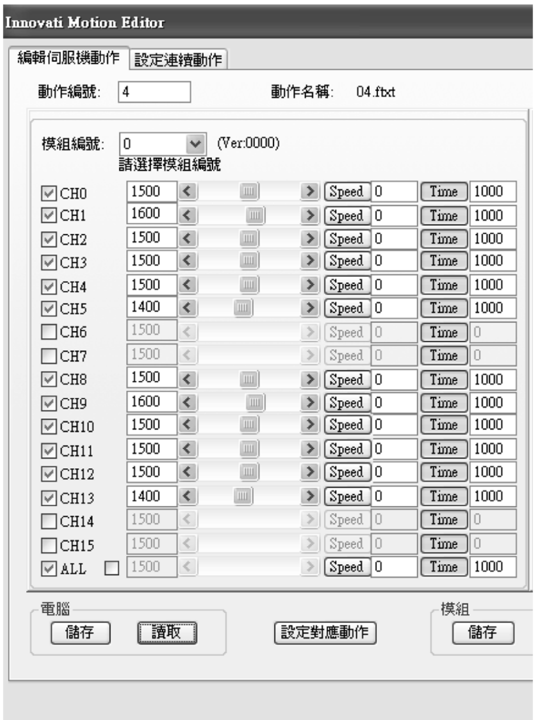

Fig. 7 Toward right :
Right foot part CH1 = 1600 CH5 = 1400
Left foot part CH9 = 1600 CH13 = 1400

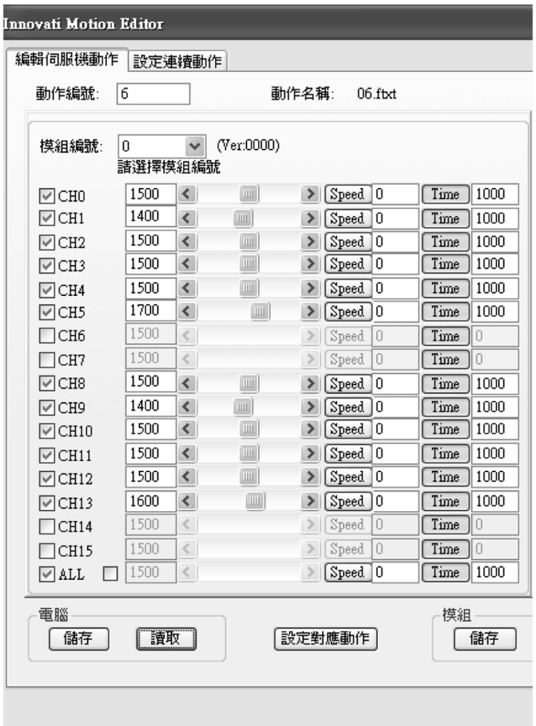

Fig. 8 Toward left :
Right foot part CH1 = 1400 CH5 = 1700
Left foot part CH9 = 1400 CH13 = 1600

4. Results and discussion

We need set number in Motion Editor which we imagine (Fig.5) that. We hope the robot can stand up slowly when it lying on floor. In the Motion Editor, CH1 to CH5 are control the right foot, and CH8 to CH13 are the left foot. For important, CH1 is upper joints (Servo). In other words, CH5 is bottom joints (Servo). In Fig. 6, we adjust CH1 = 1000, CH5 = 2101, CH9 = 2000, CH13 = 900, and Time is 3000 (3 seconds) which represents joints curved on time.

If we don't adjust the Time buttons, the robot could fall down on floor. This situation was discussed and to be solve in III. Because, Servo is fast run. But gravity can't shift quickly. So, we need to some time to transfer.

According to Fig. 6, this methods what sets the data let us divide the dance to three part. First, swaying by body, and moving between left and right, kicking.

5. Conclusions

We think that robots will work in almost all region, ranging from high technology space exploration to experiment. Accordingly, robot technique will have a momentous impact on human life, and service in case that humanoid robots has obtained an more attention.Nevertheless, We suppose intelligent robots to take part in widely in the world of the future soon, effectively interaction between the robots and humans will be necessary. To assist human– robot interaction, firstly robots should be able to localize faces and voices in home environments and the human social so that they can trackand find their communication partner —that is important function because human look directly at robots usually and addressing them.

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