參賽隊伍人員及機器人簡介

Team Member and Robot Introduction

組　　別：遙控組	指導老師：李宗禮
學校名稱：南開科技大學	隊伍名：　神瘋特搜隊
School：Nan Kai University of Technology	Team name：God mad Rescuing team

※內容需中、英對照※

壹、參賽隊伍人員：

一、指導老師　　1：教師：李宗禮

主要研究領域為工業自動化、機器人與機電整合技術。針對此一專題之製作，提供控制系統及機構設計規劃之建議。並結合理論與實務，進而達到機器人之機構、造型與動作方面有所創意。

(Advisor: Lee, Tsong-Li)

The main research areas for industrial automation, robotics and mechatronics technologies. As for this project, some recommendations about control system and mechanism design have been offered. Also, some theories and practical experience are applied so that the creative construction, formation and motion of this developed robot can be achieved.

二、組員

2：學生第 1 位 曾詠鍵

組長：負責工作編配、機構設計、CAD 設計繪圖、現場加工、鉗工加工、鑽孔加工、銑床加工、車床加工、電路配線及焊接、組裝機構零件、架構分析製作、小組採購、本組機器操作手、小組討論。

Group leader：responsible for coordination of group works, mechanism design, CAD drawing, manufacture, drilling machine elaboration, bench work elaboration, miller elaboration, lathe elaboration, cable arrangements and welding, integration of all components, analysis and manufacture of framework, group purchase, the robot operator of this group, group discussion.

3：學生第 2 位 劉喆闊

組員：負責小組工作協調、初步草圖繪製、機構設計、CAD 設計繪製、SolidWorks 繪製、架構分析製作、組裝機構零件、鑽床加工、現場加工、拍照、小組採購。

Group member: responsible for coordination of group works, sketch draw of the preliminary model mechanism design, CAD drawing, SolidWorks drawing , analysis and manufacture of framework, integration of all components, drilling machine elaboration, manufacture, photography, group purchase.

4：學生第 3 位 林昌瑞

組員：鑽床加工、鉗工加工、銑床加工、車床加工、組裝各機構零件、機構功能測試、小組討論與工作紀錄、小組採購、書面報告設計撰寫、書面資料整理。

Group member: drilling machine elaboration, bench work elaboration, miller elaboration, lathe elaboration, integration of all components, function test, group discussion and jobrecord, the robot operator of this group. group purchase, final report, written data collation.

貳、機器人簡介

一、構想與策略分析

在設計概念上，以穩定行走及成功完成關卡為原則，在這個概念下，因關卡亦有設置倒木障礙，對此採用了荷蘭藝術家泰奧楊森作品仿生獸中的連桿機構，作為機器人行走之腳部機件，此連桿機構做動時有如類人步行動作，能使機器人做出抬腳跨過障礙物之功能，便能輕易跨越倒木障礙。此外，如將此連桿機構設計成類人雙腳步行，將會造成無法保持平衡，使機器人行走時因此產生傾倒現象，為保持機器人在行走時能達到平衡，腳步機構數量增至八隻，在機器人行走時，其中四隻處於懸空其餘立於地面，方能達到平衡效果。連桿材料方面，採用鋁材方形管，鋁材質輕且具備所需求目的，不只輕且因材質比鐵材軟使加工上較為便利，材質軟利與弊皆會產生，困難之處在於連接時，固定鬆緊適中即可，否則會導致鋁方管凹陷。

1. Vision and strategy analysis

Principle, to walk stably and successfully complete the level in the design concept, under this concept, fallen trees obstacle checkpoints also set this using the Dutch artist Theo Jansen works like a class of people the bionic beast Linkage as foot mechanical walking robot, this link mechanism do moving the walking motion enables the robot to make heels across the obstacle function, can be easily across fallen trees obstacle. In addition, such as this linkage mechanism designed class people feet walk, will result not be able to maintain a balance, resulting robot walking dumping phenomenon to keep the robot can achieve a balance when walking, the footsteps of the number of institutions to eight robot walking, the four of them is still in limbo remaining stand ground as to achieve a balanced effect. Link material, the use of aluminum square tube, aluminum lightweight and with the demand, not only light and soft due to material than iron material to make the processing more convenient, the pros and cons of both will produce soft material, the difficulty lies in connection fixed elastic medium can, otherwise it will lead to aluminum square tube sag.

二、機構設計

夾取娃娃機構分別為取物手臂與籃子兩部分,取物手臂設計部分採用蹺蹺板原理,並以細鋼索分別固定鋁矩形前端和末端配合馬達之正反轉,取物手臂不作動時保持水平狀態,需夾持和掛欄時在上下擺動,由於纜車軌道高度為 200 公分,因此在鋁矩形上加裝市售電腦桌滑軌、滑輪、細鋼索配合馬達使手臂伸長,便能達到所需高度成功掛欄,籃子部分使用市售長方型花盆,花盆底部固定一平形手把,用於手臂滑軌機構末端設置之金屬夾夾取方能結合,花盆內以海棉固定於內壁四周,夾取時,手臂機構向下擺動使花盆蓋住娃娃,因海綿具彈性,由此達到夾取娃娃之目的。

2. Mechanism Design

Doll bodies were gripping the arm with the basket of two parts of the extract, the extract arm design part of the seesaw principle, the iron rope the fixed aluminum rectangular front and end with the motor reverse extract arm actuator to maintain the level of state, the required gripping and hanging bar in swing up and down due to the tramway height of 200 cm, therefore the installation of a commercially available computer desk in aluminum rectangular rails, pulleys, the iron rope with the motor so that the arm elongation will be able to reach the desired heightsuccessfully hanging bar, basket part using a commercially available rectangular flower pots, flower pots at the bottom of fix a flat shaped handle, metal clip to take before being combined for the end of the arm rails institutions set potted sponge fixed withinThe wall around gripping arm agencies downward swing so flowerpot cover doll, flexible due sponge, which reached gripping doll purpose.

三、輪子驅動設計

腳部連桿機構分為兩組,四支連桿由一顆馬達驅動,兩個連桿機構結合圓光鐵及齒型皮帶輪固定,在馬達上裝設齒型皮帶輪,經齒型皮帶傳達動力至兩邊連桿機構使其作動,兩組相同腳步機構由四支鋁材方形管平行組合固定,只需讓兩顆馬達正反轉便能讓機器人具有改變行進方向、原地自轉功能。

3.Wheel drive design

The foot linkage mechanism divided into two groups of four rod driven by a motor, two rod mechanism combines fixed circle of light iron and toothed pulleys, toothed pulley installed on the motor via a toothed belt to convey power toboth sides of the link mechanism to actuation, and the combination of two identical footsteps mechanism comprises four aluminum square tubes parallel two motor reversing fixed, just let it lets the robot has the function of changing the traveling direction, in situ rotation.

四、電路設計

機器人的控制方式為單純的繼電器控制，利用控制盒上的按鈕及搖頭開關控制 2P 繼電器控制 4P 繼電器，達到正反轉的效果。前進或後退時，兩顆馬達帶動皮帶輪正轉前進、逆轉後退；轉彎時，兩顆馬達轉向相反造成左右兩側速度差而達到轉彎的效果。這次機器人的設計有不良處，使用齒型皮帶導致馬達阻力相當大，如果要有足夠的速度卻造成力量不足。除非使用的馬達，速度與扭力俱備。還有一種:把齒行皮帶輪改換成鏈條與齒輪。這樣的改變能讓兩邊速度較為同步，不會打滑、扭力也不會相差太多。除了馬達以外，齒輪箱的壽命與強度也是一個考驗。負載過大的狀況鋰電池的消耗也非常的大，比賽前的測試大約一顆鋰電池只能比一場，就要馬上更換，最後我們把原本一組的電路分成兩組電路，也是兩組鋰電池，這樣電量的消耗就沒問題了。

4. Circuit design

The robot control method for a simple relay control button on the control box and Toggle Switch Control 2P relay control the 4P relay, to achieve positive inversion effect. Forward or reverse, two motor driven pulley is transferred forward, reverse back; turn, two motor direction opposite caused by the speed difference of the left and right sides to achieve the turning effect.The design of the robot have a bad at using a toothed belt cause motor resistance is quite large, if you have enough speed, however, created a lack of strength. Unless the use of motor speed and torque is ready. Another: tooth row the pulley switch from the chain and gears. This change allows both sides of the speed is more synchronized, will not slip, torque will not differ too much. In addition to the life and strength of the outside of the motor, gearbox is a test.Load is too big situation lithium battery consumption is very big test before the game about a lithium battery only, it is necessary to immediately replace than a Finally, we put the original circuit is divided into two groups of circuits, but also two sets of lithium batteries electricity consumption no problem.

六、組裝、測試與修改

1. 組裝

（1）以鋁材方形管組成四方形的機身。
（2）機身安裝完成後再裝上八支腳步連桿機構。
（3）馬達、齒型皮帶輪及齒型皮帶組合安裝於機構上。
（4）夾娃娃機構裝設固定於機身上方。
（5）吊籃安裝置手臂滑軌機構末端。
（6）機台整體大至安裝好後在接上繼電器以及相關線路。
（7）接上鋰電池後開啟電源亦可做動。

2. 測試與修改

測試八支腳步連桿機構做行走動作時，發現連桿接觸地面部分因接觸面和摩

擦力不足，導至機器人無法正常行走以及發生打滑現象，對此問題修改八支腳步連桿機構設計，在連桿接觸地面部分加裝圓形軟塑膠，圓形軟塑膠具彈性可讓連桿接觸地面時有緩衝效果，並在軟塑膠接觸地面位置，以防滑墊固定於其上增加摩擦力，如此機器人便能正常行走也解決打滑現象。測試手臂滑軌機構時，發現手臂滑軌伸長至纜車軌道長度不夠問題，因此將兩個滑軌組合增加伸出長度，便解決纜車無法掛上軌道問題。

1. assembly

(1) Quadrangular body with aluminum square tubes.
(2) Eight footsteps linkage mechanism is fitted in the fuselage after the completion of the installation.
(3) Motors, toothed pulleys and toothed belt assembly installed in the institutional.
(4) Clip doll institutions installed fixed in the top of the fuselage.
(5) The end of the gondola safety device arm rails institutions.
(6) Machine as a whole large installed connected to the relay and related lines.
(7) Turn on the power connected to the lithium battery can also be actuated.

2. test and modify

Link contact with the ground in part due to lack of contact surface and friction, Dao to the robot can not walk properly and slippage occurs, the issue modify eight footsteps linkage design, test eight footsteps rod institutions do the walking motion inlink ground-contacting portion of retrofitting the round flexible lance gum, the the round flexible lance gum flexible allows the cushioning effect when the rod contacts the ground, and the ground-contacting position of the flexible lance gum skid pad fixed thereon to increase the frictionforce, so the robot will be able to walk properly and also solve slippage.The test arm rails institutions found that the problem of insufficient length of the tramway the arm rails elongation to increase, so the combination of the two rails extended length would be resolved as soon as the cable car can not hang up the track.

七、機器人創意特色說明

1. 連桿材料採用鋁材方形管，鋁材質輕可減輕機器人重量。
2. 使用力量大轉速適中馬達加上皮帶使可載重的重量較大。
3. 由於機器人是以兩組四支連桿機構組成，使機器人能夠原地自轉，解決轉彎角度過大問題。
4. 採用荷蘭藝術家泰奧楊森作品仿生獸連桿機構，此連桿機構做動時有如類人步行動作，以此作為機器人行走之腳部機件。
5. 取物手臂設計以蹺蹺板原理結合滑軌伸長特性，達到夾取娃娃和掛籃動作。

6. 夾取娃娃和掛籃使用市售花盆結合海綿設計，上而下蓋住娃娃達到夾取目的，花盆底部設有兩掛勾，當手臂滑軌伸長至纜車軌道時，能輕易將吊籃掛上。

7. Robot creative Features Description

1. The link made of aluminum square tube, aluminum light weight can reduce robot weight.
2. Use moderate force large speed motor plus belt larger load weight.
3. The robot is composed of two groups of four Linkage, the robot can place rotation solve the turning angle is too large.
4. Dutch artist Theo Jansen works the bionic beast linkage mechanism, like a class of people in this linkage mechanism is done automatically when walking motion as the foot parts of the robot to walk.
5. Extract arm designed to the seesaw principle combined with rails elongation characteristics gripping doll hanging basket action.
6. Dolls and hanging basket gripping the combination sponge design using a commercially available flowerpot, and under the cover of the doll to achieve the purpose of gripping the bottom of the pot with two hooks, When the the arm rails elongation tramway, gondola easilyhang.

參、參賽心得

今年很高興能夠有這個機會代表學校自動化工程系參加 TDK 機器人比賽，這是個非常棒的經歷，雖然在設計與製作過程中，遇到許多挫折和失敗，但經過大家努力修改及克服每個環節上的問題，讓機器人能順利做出每個動作，然而在競賽中未能進入前八強，但能看到整組製作的機器人在比賽場上行走，製作的一切辛苦都值得，在休息區時我們和許多名校強隊交流，學習到各種不同的設計概念和連桿機構，這次參賽讓我們收穫良多，希望還有機會參加 TDK 機器人製作比賽。

Very pleased to have this opportunity on behalf of the School of Automation Engineering participated the TDK robot game, this is a great experience in the design and production process, encountered many setbacks and failures, but after all efforts to modify and overcome each linkthe problem, so that the robot can successfully make each action, however, failed to Jinruqianba strong competition, but making the robot able to see the whole group walking in the playing field, and made all the hard work is worth, in the lounge area.and many elite top teams exchange, learn a variety of design concepts and Linkage, this competition so we learned a lot, and hope to have the opportunity to participate in TDK robot making competition.