參賽隊伍人員及機器人簡介

Team Member and Robot Introduction

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貳、機器人簡介

一、構想與策略分析

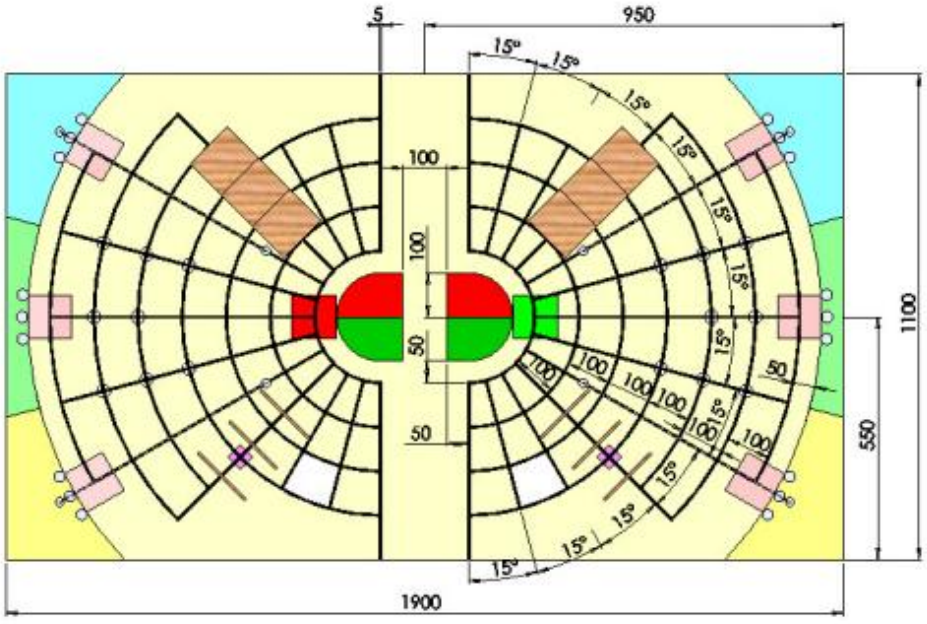
(1) 構想(The concept)：

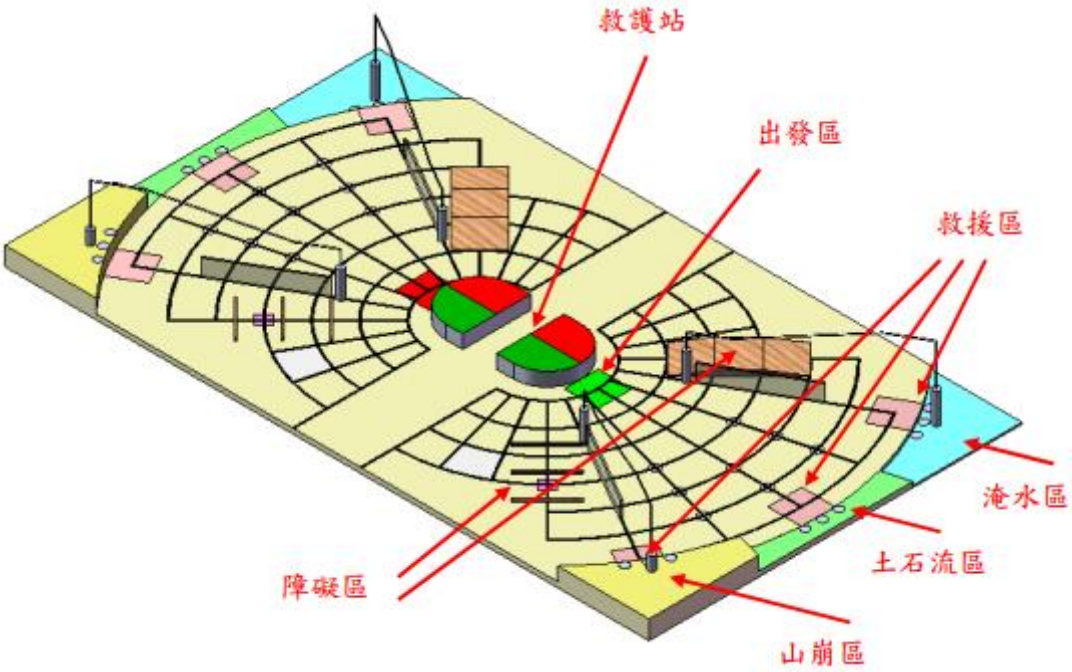
一開始所想的是一些複雜的移動方式，在腳部的關節處有非常多的零件，像是使用上升→前進→放下的方式進行移動，但是發現腳前進一步就要進行上述的三個動作，所以便思考如何使用快速且簡單的點接觸方式來達成快速的移動，然後便想到在馬達的軸上裝一彎曲鋼管來旋轉前進，不過在製作到一半時發現這樣算輪輻，不符合比賽規定。所以改成類似火車行走的方式來作動，一樣是馬達的軸來帶動旋轉，並配合滑軌來讓腳進行上下移

動。手臂的部分則是以可垂直升降的氣壓桿搭配夾爪及特製吊籃來夾取。

Beginning to think is some complex moves, very much part of the joints in the foot move, such as using the rise → forward → put down the way, but found that the above three actions will be carried forward in the foot, thinking about how to use the fast and simple point-contact way to achieve fast moving, bending steel pipes installed in the shaft of the motor to rotate forward and then they think they found that this operator spoke, but in production to half, does not comply with competition requirements. So I changed it into a similar trains as moving as the motor shaft rotates with the rails to allow the foot to move up and down. Part of the arm in the vertical lift pressure lever with jaws and special gondola to gripping.

(2) 策略分析(policy analysis)：





參賽隊伍人員及機器人簡介

Team Member and Robot Introduction

1. 倒木障礙(Fallen trees obstacles):

機器人在這個區域是以直接行走的方式來跨越 5cm 的障礙。

The robot walking directly in this area is based on the way to span 5 Centimeter obstacles.

2.便橋障礙(Temporary bridge obstacle):

在這個區域機器人也是以直接行走的方式來過上下坡。

In this area of the robot is to live a direct walking downhill

3.山崩區(Landslide area):

在這個區域我們讓機械手臂可垂直 90 度的方式做上升下降，土石流區的高度爲 40cm，而手臂可升高超過兩公尺，再配合一個特製吊籃直接套住娃娃並懸掛上去。

Mechanical arm in this area, we can be 90 degrees vertical way do rise and fall, the mudslide zone height of 40cm, the arm can be elevated more than two meters, together with a specially made the gondola directly entangle dolls and hanging up.

4.土石流與淹水區

(Mudslides and flooding the area):

這兩個區域也是同樣採用上述的方式，由於娃娃所在的位置一個是與機器人平面另一個則是低 10cm，所以手臂的下降量至少 60cm 來確保可以夾取娃娃。

These two areas is also the same manner described above, doll location of a plane in the other with the robot is low 10cm, so the amount of drop of the arm of at least 60cm to ensure that the gripping doll.

5.纜車軌道(Tramway):

利用手臂可伸縮的特性將機器人移動至軌道旁，在利用氣壓夾爪取下掛在軌道上的娃娃並放回救援平台上。

Characteristics of the robot arm scalable folder to move to the next track in the use of air pressure claws remove the doll hanging on track and back into the rescue platform.

參賽隊伍人員及機器人簡介

Team Member and Robot Introduction

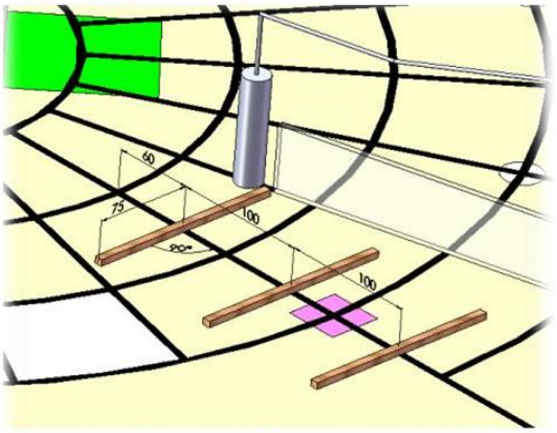


圖 4(a) 倒木位置

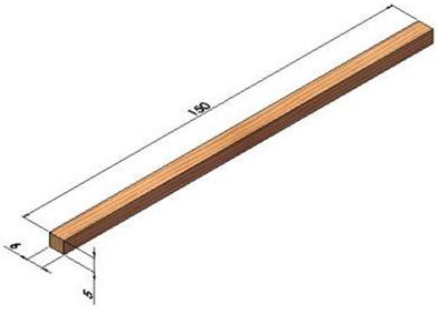


圖 4(b) 倒木尺寸 (單位：cm)

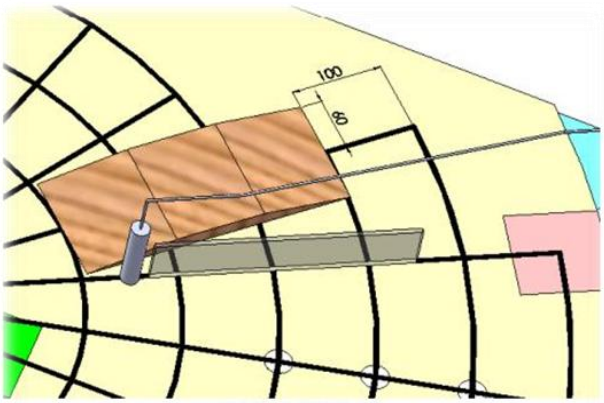


圖 5(a) 便橋位置

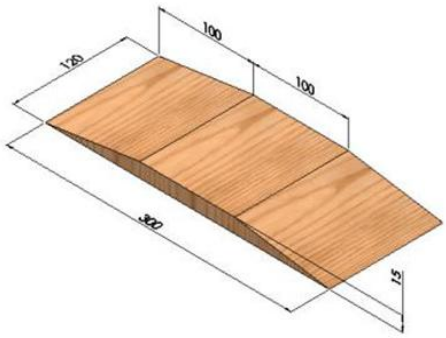


圖 5(b) 便橋尺寸 (單位：cm)

二、機構設計

1.腳部機構設計(Foot mechanism design):

我們參考類似火車行走的方式來設計，馬達的軸轉動來帶動腳部，在腳部的鋁材上有一滑槽，在馬達轉動時便可以在滑槽範圍內進行上下移動，滑槽的長度爲 13cm，兩邊各預留 1cm，所以實際上移動時移動範圍爲 11cm 左右。在行走時腳部抬起離地面上大約有 7 公分的距離，所以對於倒木障礙與便橋障礙來說是可以直行通過的。

We refer to similar manner to design trains, the axis of rotation of the motor to drive the foot, the foot of aluminum has a chute in the rotation of the motor can be moved up and down in the chute within the chute length13cm, each side reserved 1cm, so this is actually a range of movement when moving about 11cm. Feet lift off the ground when walking about 7 cm distance for fallen trees obstacles and temporary bridge barriers can go straight through.

2.手部機構設計(Hand mechanism design):

在機體三分之一處裝上空心鋁矩形當作直立桿，並在直立桿

上安裝上一個可上升下降的渦桿渦輪機構，並在頂端處套上一個可上下旋轉的軸作爲手臂上下移動的依據，最後在前端裝上可伸縮 50cm 的氣壓桿並在前端裝上氣壓夾爪。

Deemed upright bars mounted at the body third hollow aluminum rectangle, and the installation of the upright rod on a vortex rod turbine can be increased to decrease, and put at the tip of a vertically rotating shaft as the arm moves up and downbasis, and finally the front-end loading scalable the 50cm air pressure lever and on the front-end loading pressure jaws.

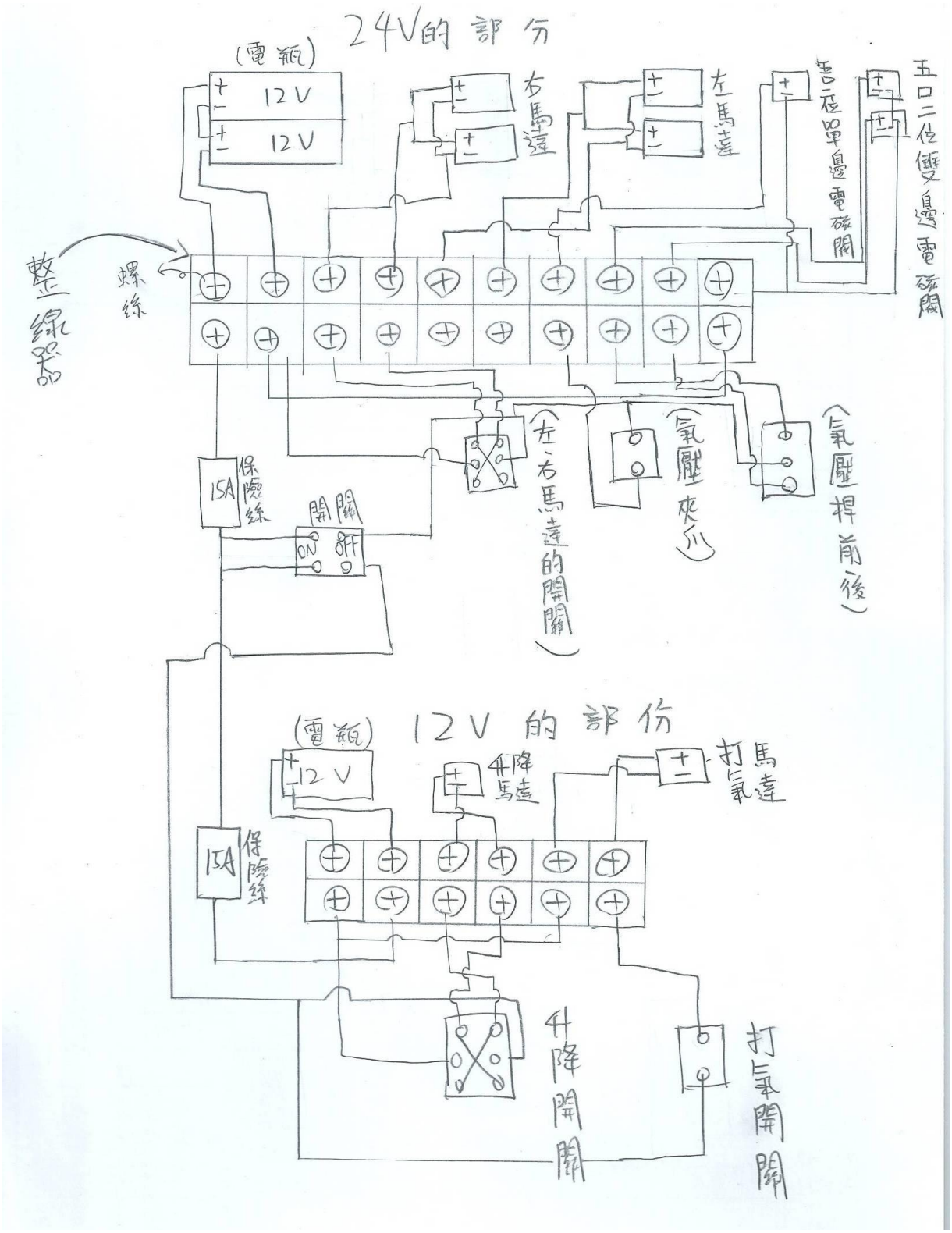
三、電路設計(Circuit design)

在機器人腳部控制的部分是將兩個 12V 的電瓶串聯成 24V，再將四顆馬達的正極與負極接到掀動開關上完成迴路，並在電源開關前接上一個 15A 的保險絲，而手臂的伸縮以及夾爪是使用五口二位電磁閥接上 ONOFF 開關以及掀動開關兩者來控制。

In the control part of the robot foot two 12V batteries in series into 24V, then four positive and negative motor connected to the tilt switch to complete the circuit, connected to a 15A fuse before the power switch, while the armstretching jaws five two solenoid valve connected to the ONOFF switch tilt switch both to control.

參賽隊伍人員及機器人簡介

Team Member and Robot Introduction



四、組裝、測試與修改(Assembly, test, and modify)

在材料組裝的部分我們並沒有如預期般的順利，在最原始的機器人骨架上採用 4*4 的方型鋁材(圖一)，而在動力的方面採用 40w 的馬達(圖二)，在組裝到一半的過程馬上就發現到重量太重的問題，光是 4 根最主要的結構就有 6 公斤，而馬達單顆更是重達了 2.5 公斤，於是把馬達的部分換成了 5w(圖三)，單顆重量爲 600 克左右，而骨架的部分改成 3*3 的方型鋁材並鑽孔減輕重量(圖四)，準備組裝時老師提議說以 L 型鋁材焊接(圖五)的方式絕對可以讓重量大幅縮減，因爲這樣可以減少螺絲與螺帽的使用且材料強度足夠。

Part we did not as expected smooth the material assembled in the most primitive robot skeleton 4 * 4 square aluminum (Figure 1) powered 40w motor (Figure 2),When assembled to half of the process immediately to the problem of the weight is too heavy, light four main structure, there are six kilograms, while motor single weighs 2.5 kg, so part of the motor replaced 5w (c), single weight of 600 grams, while the part of the skeleton into a 3 × 3 square aluminum and drilled to reduce weight (d), ready to assemble the teacher suggested that L-type aluminum welding (Figuree) ways can definitely let the weight substantially reduced, because it can reduce the use

of screws and nuts and materials of sufficient strength.

將新馬達與腳部的機構零件以及電瓶等等組裝完成(圖六)，並開始測試行走，在機器人行走時首先遇到的問題就是馬達不太夠力，會發生腳部結構撐不起來且會在馬達軸處鬆脫的現象，不過在將鋼管與馬達軸焊接起來後問題就改善許多(圖七)。

New motor and the body parts of the foot, as well as battery assembly (Figure 6), and began to test walking robot walking first problem is the motor is not quite enough force will occur foot structure do not hold up andwill loose at the motor shaft, but many (Figure 7) on the improvement of welded steel pipe and motor shaft.

接著是手臂的安裝，在機體三分之一處安裝手臂直立桿的部分並用鋁板加強結構強度(圖八)，並將兩個 L 型鋁材以洗床削短(圖九)後合併焊接起來當作放置氣壓夾爪的部位(圖十)，測試手臂伸長最高可達 2 公尺左右 (圖十一)。

Followed by the installation of the arm, installed in one-third of the body

arm upright part of the bar and enhance structural strength aluminum plate (Figure 8), and two L-shaped aluminum to wash bed (Figure 9) cut short after the merger welded togetherdeemed to be placed pneumatic gripper parts (Figure 10), the test arm elongation up to 2 meters (Figure 11).

接著更改夾爪的部分，將夾爪左右兩端安裝上圓弧形狀的鐵絲，以及在內部設計一個內爪可以固定保特瓶蓋行的特製籠子(圖十二)，目的是除了可以將娃娃掛上纜車軌道之外還可以使用夾爪夾取多餘的娃娃，最後安裝上一顆五口二位的單邊電磁閥以及五口二位的雙邊電磁閥來控制夾爪開關以及氣壓桿的伸縮，並將電線整流在機體後方(圖十三)。

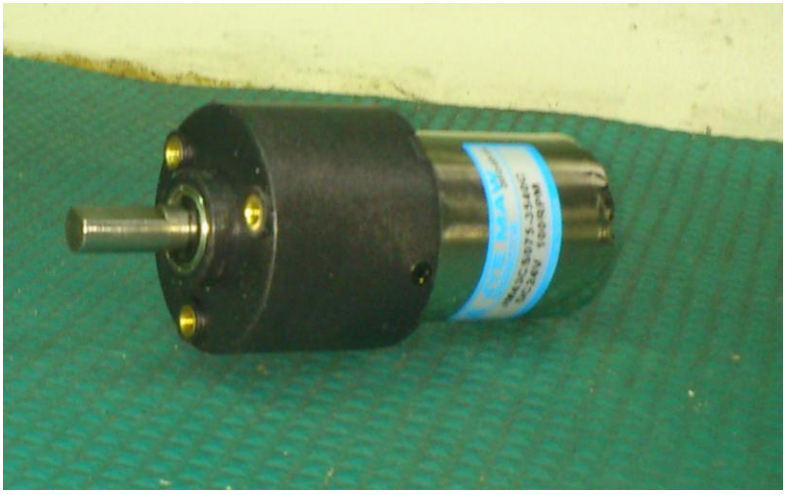
Then change the jaw portion, the jaw around installed at both ends of the arc shape of the wire, as well as in the internal design an inner claw can be fixed paute cap row specially cage (Figure 12), the purpose is in addition to the doll canhang outside the tramway can also use the the gripping jaws excess dolls, final installation on a five unilateral two solenoid valves, and five two bilateral solenoid valve to control the jaw switch as well as the pressure lever telescopicand wire rectifier behind the body (Figure 13).

參賽隊伍人員及機器人簡介

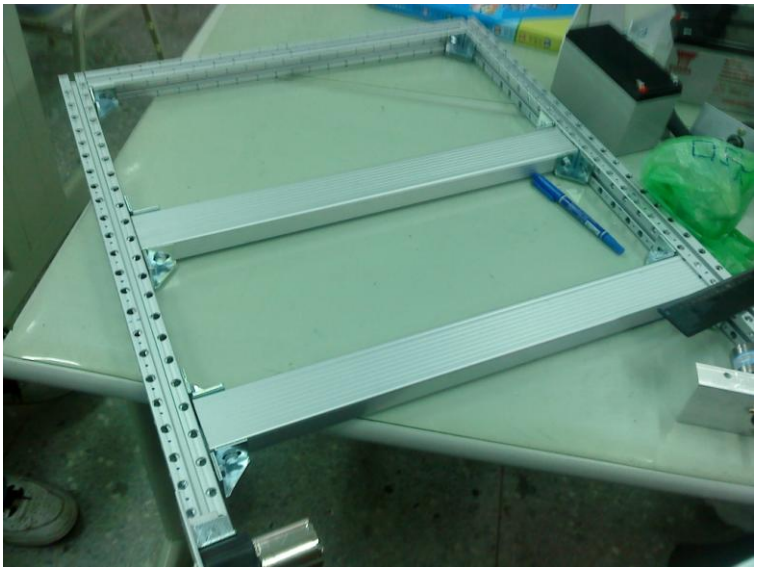
Team Member and Robot Introduction

圖一

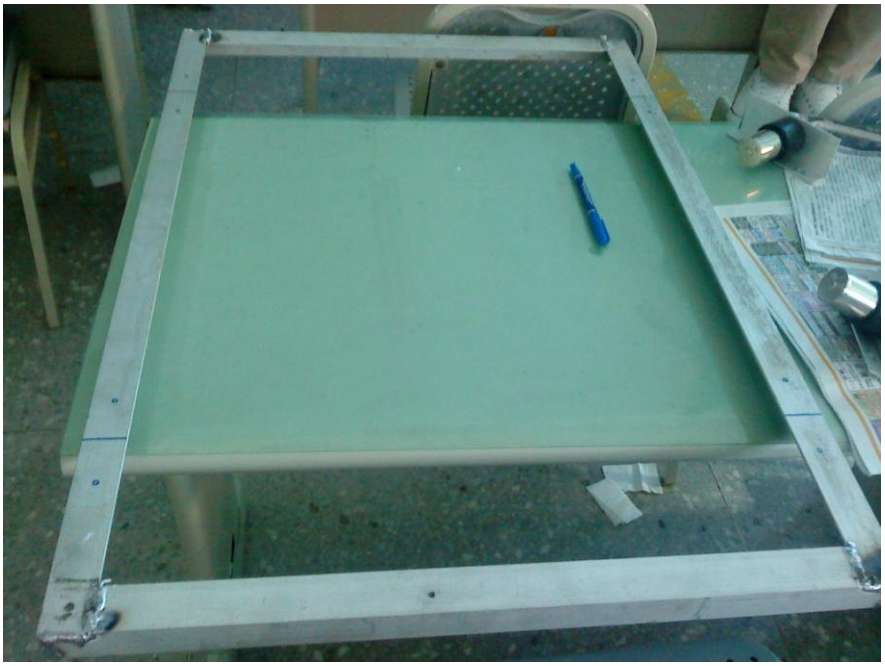
圖二



圖三



圖四



圖五

圖六

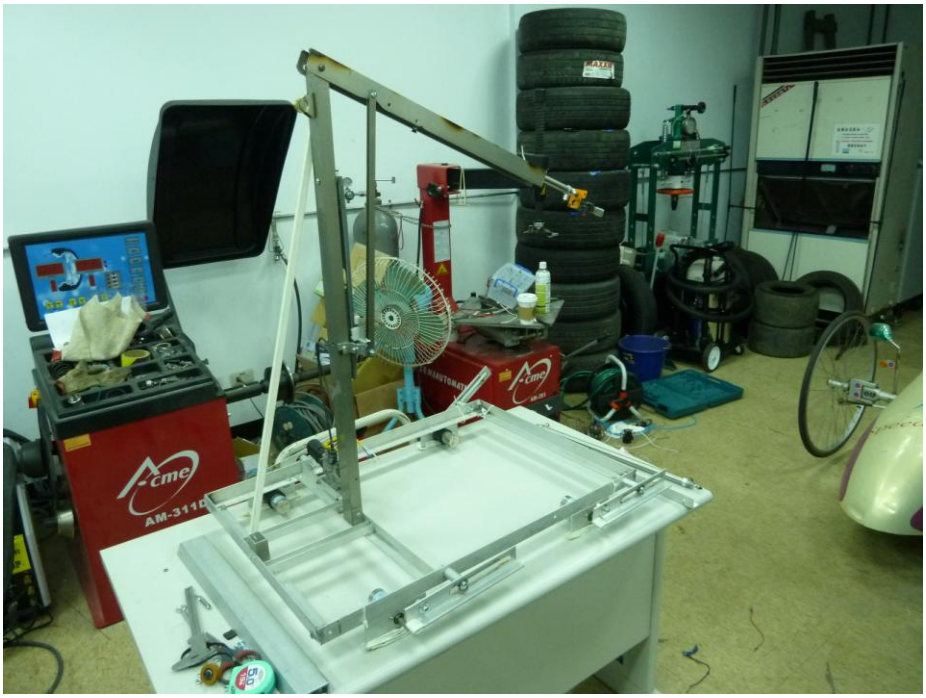
圖七

圖八

參賽隊伍人員及機器人簡介

Team Member and Robot Introduction

圖九

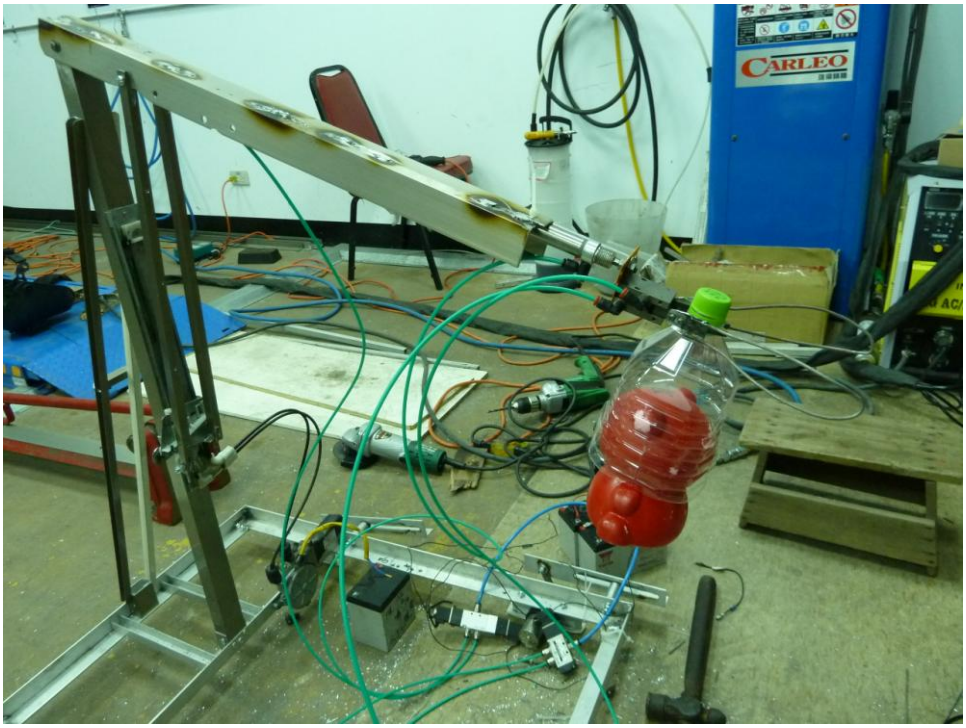


圖十

參賽隊伍人員及機器人簡介

Team Member and Robot Introduction

圖十一



圖十二

圖十三

五、機器人創意特色說明

有時候複雜並不一定代表比較好，我們的機器人在製作時原先也是想用複雜的腳部機構方式來行走，但最後採用的是類似火車輪移動的方式行走，而行走的方式原本是採用斜對角的腳部機構同時作動行走，可是發現在移動的過程會劇烈搖晃，所以嘗試了四隻腳部機構一起做動，沒想到這種類似海豹雙手拍地前進的方式不但穩定很多，在加上我們機器人的底盤結構距離地面大約只有 5cm，移動時撐高到 13cm 這對於整體的平衡很有幫助。

Sometimes complex does not necessarily represent the better our robot also wish to use the a complex foot institutions way to walk in the production of original, but in the end is a similar train wheels move walking, walking originally used obliquefoot diagonal institutions at the same time as moving walk, but found the process of moving violent shaking, so try the four legs of the Ministry of agencies do moving, I did not expect this similar seals hands shot forward not only the stability of many inplus our robot's chassis structure from the ground only about 5cm, moves stays high to 13cm for the overall balance of helpful.

整合上述所說的，腳部及底盤結構因爲機構簡單所以作動速度快，相對的移動速度也快，以 3 公尺測試的情況下大約只需要花費 20 秒左右，且不易劇烈晃動。

Integration mentioned above, the foot and chassis structure because the agency simple so fast action and relative movement speed is too fast, about 3 meters test case takes only about 20 seconds, and difficult to violent shaking.

而手臂的部分將夾爪裝上特製吊籠用套的方式將娃娃套住，且可以伸縮，所以不管是高處或是平面處與低處的部分都可以夾取的到，並在機體前方處放置一個固定的籃子，這樣除了可以掛上娃娃外也可以將娃娃放置於機體內。

And part of the arm jaws mounted on a specially designed cage sets doll trap, and retractable, so regardless of height or plane at the lower part of the gripping to the front of the bodyplaced at a fixed basket Besides doll can hang dolls placed in the body.

參賽隊伍人員及機器人簡介

Team Member and Robot Introduction

參、參賽心得

雖然是第一次參加這種模式的比賽，但這幾個月下來，我們真的學習到很多，如:要買的材料要知道相關規格尺寸、機構如何設計、如何將所想的設計圖實體化等等，雖然在製作的過程中常遇到困難，但我們還是努力的完成機器人。

Although this is the first time to participate in the game in this mode, but this is a few months, we really learned a lot, such as: to buy materials to know the size of the relevant specifications, how to design, how to design materialized think, although the difficulties often encountered in the production process, but we still strive to complete the robot.

比賽當天，看到大家的機體都有不同特色，也利用有限的時間看各種學校的機器人比賽成果如何，也讓我們知道要如何發揮才能贏得比賽。雖然時間剛好，我們三關大概都有過關，但三次分數平均下來，些微之差沒進八強。

Race day, to see everyone's body has different characteristics, but also take advantage of the limited time to see how the results of various school robot

competition, also let us know how to play to win the game. Time just three passes of us probably have a clearance, but three scores on average, a slight difference went into the quarterfinals.

很感謝老師們的幫忙，同學一起努力完成了機器人。雖然沒得名，不過我們真的實際體驗了一個產品的產生過程，而不是一直憑空想像沒實際的做出實體。

Very grateful to the help of the teachers and students work together to complete the robot. Although he did not name, but we do the actual experience of the production process of a product, rather than has been imagined did not make an actual entity.