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

命名源起與構想：

因規則有限制搖控組機器人設計必須以輪流交互「著地」、「離地」之方式運動前進，不可有輪型的設計，但是此比賽不但比快還比創意，我們便想設計出具有特色與創意的機器人。

最剛開始的靈感是動物，因為擬動物機器人也別具特色，我們便以 lego 來兜出靈感(如下圖 1-1 所示)，此機器人是藉由摩擦力來帶動整隻機器人移動，以跳躍的方式前進，我們便以此作為雛形，來做出本次 TDK 大賽的機器人。

此機器人前進時的動作相當的具特色，跳躍式的前進，宛如一隻青蛙一樣，我們便將此機器人以青蛙英文的諧音來命名為「**佛羅格**」。

II、robot Profile

1.A vision and strategy analysis

參賽隊伍人員及機器人簡介

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Naming originated with the idea:

Remote group of robot design must take turns interaction "to", "off the ground" movement forward there are restrictions due to the rules, not round-design, but this game is not only faster than creativity, we would like to label design has Features and creative robot.

Least the beginning of inspiration is the animal, is also unique because the proposed animal robots, we lego to pocket the inspiration (as shown in Figure 1-1), this robot is driven by friction to the whole robot moves to jumping forward, we as a prototype to make the the TDK contest the robot.

This action when the robot forward quite distinctive leap forward, like a frog, we have this robot frog English homonym named "**Fo Luoge**"

圖 1－1

策略分析：快、狠、準

1. 快：利用摩擦力，促使機器人快速的往前跳動，再理想的時間內到達任務地點。

2. 狠：「倒木」障礙與「便橋」障礙以特別設計過的足部機構快速通過障礙。

3. 準：我們以套筒的設計來加快抓娃娃的速度，不但準度不用很高也可以節省對準的時間，之後再以分離式套筒準確與快速的將

娃娃掛置於鋼索上。

二、機構設計

機構方面此機器人分為三大部分，分別為**爬行機構**、**螺桿機構**與**爪子**。

爬行機構(如下圖 2-1 所示)，我們以簡單的連桿機構達到我們理想的動作，但也是要注意機構行動中的死點，加上它只能行走固定的距離，再轉彎方面也是有很大的問題，旋轉角度難以控制會有過大之問題，因爬行機構是使用摩擦力來帶動整隻機器人，再與地板摩擦的材質也要慎選。

由於爬行機構設計簡單，所以我們再另行設計**螺桿機構**(如下圖 2-2 所示)來彌補爬行機構旋轉角度難以控制之缺點，此螺桿機構必須撐起整台機器人並旋轉此機器人到理想之角度，固此螺桿機構是整台機器人的重心，但礙於規則上體重的限制，在馬達的選用方面卻要謹慎。

爪子的設計，為了配合戰術與時間上的限制，我們更改為**套筒**式的抓取方式(如下圖 2-3 所示)，並非一般所見的爪子，但還考慮到爬行機構有行走距離固定之缺點與場地高低差之不可變素，我們使套筒可以前後與上下的移動，來克服爬行機構的行走固定距離與場地高地差，此外，套筒的徑口可加大，來彌補螺桿機構的旋轉角度不慎精確之缺陷。

Strategic Analysis: fast、aggressive、accurate

1.Fast: using friction, prompting the robot to fast forward, beating, then the ideal time to reach the mission locations.

2.Ruthless: "fallen trees" obstacles "temporary bridge" obstacle to the specially designed foot institutions quickly through the obstacles.

3.Level: we grasp the speed of the doll to speed up the design of the sleeve, not only do not have a high accuracy

can also save the time of the alignment, then a separate sleeve accurately and quickly hung the doll placed on the cable.

Second、the mechanism design

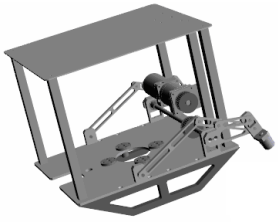
Institutional aspects of this robot is divided into three parts, were **crawling institutions、screw mechanism、claws.**

The **crawling mechanism** (as shown in Figure 2-1), we achieve our ideal operation of a simple link mechanism, but also important to note the mechanism action of the dead point, plus it can only travel a fixed distance, and then turning aspect is has a big problem, the rotational angle is difficult to control will be too large in the crawling mechanism is to use friction to drive the whole robot, and friction with the floor of the material should also carefully selected.

The the crawling mechanism design is simple, so we'll be designed **screw mechanism** (as shown in Figure 2-2) to make up for the drawback is difficult to control to crawling institutions rotation angle the screw mechanism must hold up the whole robot and rotation to the ideal angle of this robot , solid screw mechanism is the center of gravity of the whole robot, but due to the weight restrictions on the rules, in the selection of aspects of the motor have to be cautious.

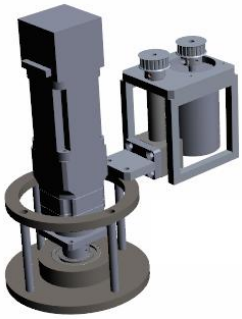
Paw design, in order to meet the tactical time constraints, we change the sleeve **crawl** (as shown in Figure 2-3), is not generally seen in the claws, but also taking into account crawl bodies walking distance fixed height difference of immutable prime shortcomings venue, the sleeve can be moved up and down, so as to overcome the the fixed walking distance of crawling institutions venue Heights, sleeve diameter can

increase the port, to make up for the screw mechanism rotation angle inadvertently accurate defect.



(圖 2-1、爬行機構)

(Figure 2-1, crawling agencies)



(圖 2-2、螺桿機構)

(Figure 2-2, the screw mechanism)

(圖 2-3、套筒)

(Figure 2-3, sleeve)

三、輪子驅動設計

驅動系統主要設備包括電池、直流無刷馬達、傳動機構、控制及保護裝置等所構成。

而驅動方面，我們選擇 80w 直流無刷馬達來帶動爬行機構因額定電壓為 24vdc，所以我們使用 24v 的電池去搭配，使之能達到最佳的工作狀態，至於為何使用 80w 的馬達呢?而不是選擇其他 w 數較高的馬達，最大的原因就是轉矩，假如轉距過大就會造成多餘的浪費，那不如降低轉距，也可有較快的速度，然而我們有個固定的負載 25kg，所以必須在這負載下選擇適合的馬達，適當的轉距，同時也要達到滿意的速度，才不會造成多餘的浪費。

茲就電池、直流無刷馬達說明如下：

鋰電池: 鋰電池(如下圖 3-1 所示)為 24V10AH 由串聯而成，分別供應機器人上各電力設備之需，如無刷馬達、控制器等。鋰電池的組成主要有正極(鋰鈷化合物)、負極(碳材)、隔離膜(隔開正負極，僅允許鋰離子通過，同時有緩衝避免熱失控功能)、電解液(鋰鹽類流體，供鋰離子傳導) ，進行放電時，鋰離子自然地出能量較高的負極材料移往能量較低的正極材料而對外釋放能量(電能)。此外，整個反應過程中沒有鋰金屬的存在，因此稱之為鋰電池。

直流無刷馬達: 無刷馬達(如下圖 3-2 所示)直接經由 24V10AH 電池提供電力來轉動，而馬達直接與傳動構件連接，藉以帶動整隻機器人。無刷馬達特性: 效率高、扭力高、安定性高、體積小省空間、低電磁干擾、轉子體積比傳統感應馬達及有刷馬達小非常多，擁有較佳的控制性能。

Three wheel drive design

The drive system equipment, including batteries, brushless DC motor drive mechanism, control and protection devices posed. Drive, we chose 80w DC brushless motor rated voltage 24vdc driven crawling bodies, so we use the 24v battery to match, so that it can achieve the best working condition, As to why use 80w motor? Instead of choosing other higher w motor, the biggest reason is the torque, if the torque is too large will cause excess waste, it is better to reduce the torque, may also have a faster speed, however, we have a fixed load25kg, so this load must select a suitable motor, the appropriate torque, but also to achieve satisfactory speed, it does not cause excess waste.

Taishin batteries, brushless DC motor description is as follows:

Lithium battery: Lithium battery 24V10AH series (as shown in Figure 3-1), respectively supply the robot power equipment needs, such as brushless motors, controllers, and so on.

Lithium battery mainly composed of a positive electrode (lithium cobalt compound), a negative electrode (carbon material), the insulating film (spaced apart positive and negative electrodes and allow only lithium ions to pass through, while a buffer to avoid thermal runaway function), electrolyte (lithium salts fluid, for lithium ion conductivity), when discharging, lithium ions naturally out of the migration of the negative electrode material of higher energy to lower energy of the cathode material and the external release of energy (electricity). In addition, the entire reaction process without the presence of a lithium metal, so called lithium battery.

DC brushless motor: Brushless motor (as shown in Figure 3-2) directly via 24V10AH battery power to turn the motor directly connected to the transmission components, thereby giving impetus to the whole robot. Brushless motor characteristics: high efficiency, high torque, high stability, small size, space-saving, low electromagnetic interference the rotor volume than conventional induction motor and brush motor small, has better control performance.

（圖 3-1、24vdc 鋰電池）

(3-1, 24 vdc lithium battery)

（圖 3-2、直流無刷馬達）

(Figure 3-2, brushless DC motor)

四、電路設計

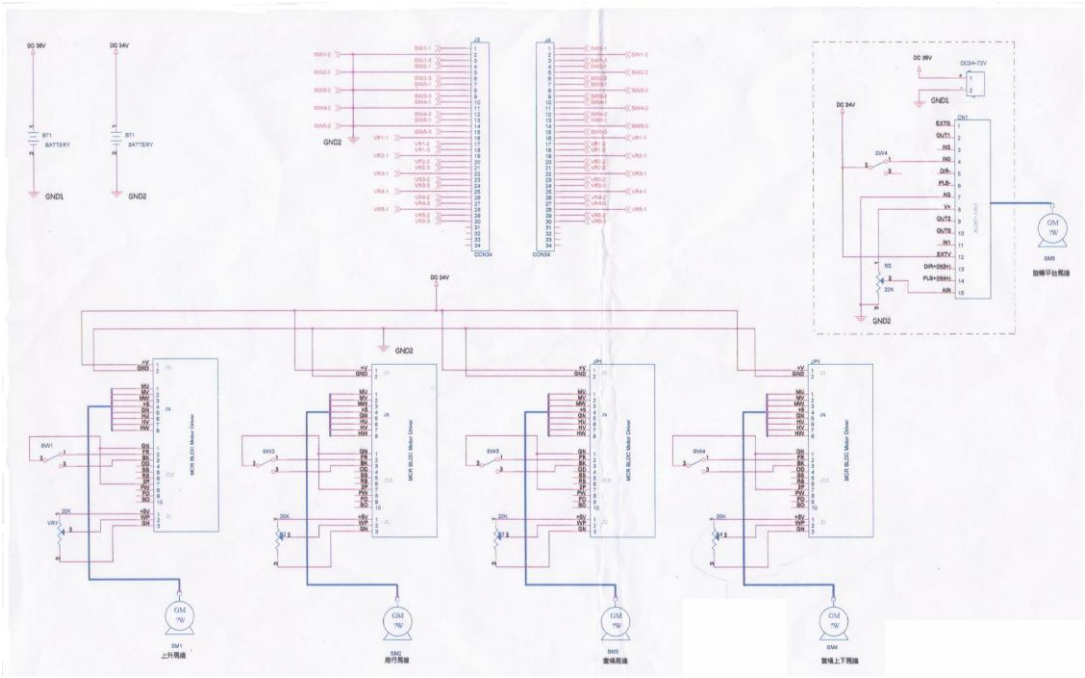
在電路的設計上，因礙於我們本科屬於機械，再電的領域上認知有限，所以我們的設計較為單純，使用鋰電池連接驅動器再連接至電池與控制器(如下圖 4-1 所示)。

而控制採用有線控制，使用三段式波斷開關，控制機器人的前後，再使用可變電阻改變機器人轉速(如下圖 4-2 所示)。

Fourth, the circuit design

Circuit design, because our undergraduate mechanical limited cognitive re-power field, so we design is relatively simple, the lithium battery connected to the drive and then connected to the battery and controller (as Figure 4-1).

Control wired control, using the three-stage wave off switch to control the front and rear of the robot, and then using the variable resistor to change the robot speed (as shown in Figure 4-2).



（圖 4-1、電路圖）

(Figure 4-1, circuit diagram)

（圖 4-2、控制器）

(Figure 4-2, the controller)

五、 組裝、測試與修改

組裝:

機器整體以鋁材組成，只有少數部位以塑膠來代替，選用鋁材是因為好加工、質量輕，在有限重的規定下較好控制機器整體重量，至於為何不選用更加工、質量更輕的材質?再強度的考量方面，不宜選用，而鋁材可以使用陽極處理，來增強其硬度、耐磨性……等。

機器人主要有上下兩層，三大部位(如下圖 5-1 所示)，下層包含足部機構與螺桿機構，共有三顆馬達，分別為兩顆 80w 無刷馬達與 22kgcm 步進馬達，足部機構的連桿為了增加其硬度與軸承耐磨性，使用了硬度陽極處理，同時為了減輕重量，在不破壞機構強度的狀況下，銑掉多於的材料。

上層則是套筒機構，兩顆馬達，為兩顆 40w 無刷馬達，一顆帶動套統機構上下移動以利套統套入娃娃，另一顆馬達則是帶動整個套統機構前後移動，補足爬行機構對準娃娃行程過大的缺陷，此機構可將套統機構前後移動微調，以利瞄準套入娃娃。

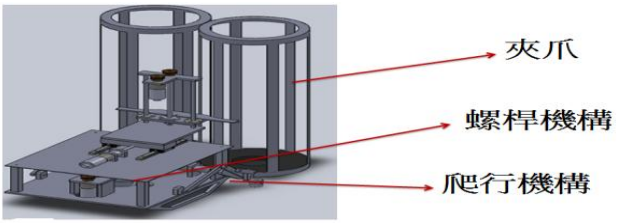
Five、 Assembly, test and modify

Assembly: Machine as a whole composed of aluminum, only a small number of parts instead of plastic, made of aluminum because good processing, light quality, better control the weight of the machine as a whole under the provisions of limited weight, processing Why not choose lightermaterial? again to the strength considerations should not be optional, anodized aluminum can to enhance its hardness, wear resistance ... and so on.

Robot upper and lower levels, three parts 5-1 (as shown), the lower to contain foot institutions screw mechanism, a total of three motors were two 80w the brushless motor 22kgcm stepper motor, footmechanism rod in order to increase its hardness and bearing wear resistance, the use of the hardness of the anodic

treatment, in order to reduce the weight at the same time does not destroy the status of the mechanical strength, milling out more material.

The upper sleeve institutions, two motors, two 40w brushless motor, a driven sets the system to move up and down in order to facilitate the Commission set into the doll sets, another one motor is driven to move around the entire set of system institutions to supplementcrawling institutions aligned doll stroke is too large defects, the move sets of system institutions before and after fine-tuning, in order to facilitate the targeting set into the doll.



（圖 5-1、機器人整體圖）

(Figure 5-1, the robot overall view)

測試與修改:

再測試足部機構時，行走時會有右彎的問題，發現是兩支腳沒有同時著地，兩邊不等高，左高右低的問題，或許是因為在製作連桿機構時，誤差的疊加而造成此問題，再行走木條達到最高點時，腳會有搆不到木條的問題。可能的修改為增長腳的長度使其等高，最壞的狀況為重製連桿機構。

在行走上坡時會有打滑的問題。更改摩擦係數更大的材質或加重其重量，$f=\mu N$。

六、機器人創意特色說明

此機器人是參考蛙的行動方式來設計的，它在行走時宛如一隻巨大的青蛙，拔山倒樹而來。

足部機構雖然只是簡單的連桿機構所拼湊而成，但卻能真實呈現出我們的設計理念，完美的詮釋出我們想給觀看的人什麼樣的感

覺，它在行走時，便能讓人一眼瞧出它像隻蛙。

在爪的設計上，我們更改為套筒的的設計，此設計不但是為了戰術與時間上的考量，同時也為了詮釋出，這套筒就像牛蛙的肚子一般，彷彿可裝下無數隻娃娃，其裝套的速度有如狼吞虎嚥般的迅速。

螺桿機構也是個別具心裁的設計，其最大的功能是旋轉角度，但是此機構還有一個特色，它就像是個「旋轉展示平檯」，跟汽車的展示平檯一樣，我是今天的焦點，觀眾可以從各種角度觀察!!!

七、討論

這是我們設計的第一隻機器人，雖然設計上略帶點稚氣，再過程中也遇到了許多的問題，但還是一步一步的去克服，所看到的，體驗到的，不是從書紙上所能學習到的，或許你可以在書上學到陽極處理，陽極處理分很多種，有一般性陽極處理、半硬膜陽極處理、硬膜性陽極處理……等，多種的陽極處理硬度、膜厚……等，也有不同的分別，但只看書上所形容的，沒有實際看過，怎麼能更深刻的了解呢?

經由此次的比賽，所學習到的無非只有如何設計一台機器人，在團隊上也學習到互助合作的重要性，也了解到對待一件事，最重要的是態度與解決事情的方法，遇到問題和錯誤不能只想著迴避或怪罪他人，要先想如何解決問題，彌補錯誤，度過難關。

Test and modify:

Walking, then test the foot institutions have the right bend, is two feet no ground on both sides of unequal height, right low left high, perhaps in the production of the link mechanism, errorsuperposition caused this problem, walking wood to reach the highest point, the foot structure is less than the problem of the wood. Possible changes to the high-growth in the length of the foot make it, the worst case scenario for the remake Linkage.

Will be slippery when walking uphill. Change the greater coefficient of friction of the material or increase its weight, $f = \mu N$.

Six、 robotics creative Feature

This robot Reference frog action, walking like a huge frog,

Nukiyama inverted tree from

Foot institutions simply link mechanism patchwork, but it can truly showing our design philosophy, the perfect interpretation of a feel of what kind of people we want to watch it in walking, it can make peopleThe a Qiaochu it is like frogs. Claw design, we change the design of the sleeve, this design not only for tactical time considerations, as well as order to interpret the sleeve like a bullfrog's belly, as if to hold countless dolljacketed speed is like devour as quickly.

Screw mechanism is individual conception design, its biggest feature is the angle of rotation, but this agency has a special feature, it looks like a "rotating display platform, with the car display platform, I was the focus of today, The audience can be viewed from various angles!!!

Seven、to discuss

This is the first robots, we design design, slightly childish, again, the process also encountered many problems, but step by step to overcome, see, and experience, not on paper are from the booklearn, maybe you can go to school in the book to the anode, anode are many different kinds, general anodized semi-dural anodized, subdural anodized ... a variety of anodized hardness, thickness..... and so on, but also different, but only read books on to describe, not actually seen, how can a deeper understanding of it?

Nothing more than only through the game, learn how to design a robot, the team also learned the importance of cooperation and mutual assistance, and also learned to treat one thing, the most important is the attitude and resolve things, the case of to problems and errors can not only sidestep or blame others, we must first think how to solve problems, to make up for the error, and tide over the difficulties.

參、參賽心得

參賽隊伍人員及機器人簡介

Team Member and Robot Introduction

這次比賽雖然是我們第一次參賽，卻絲毫沒有懈怠的念頭，到場之後才發現其他學校設計的足部機構速度非常的快，發現了我們這組最初的足部設計就有些許的問題，在這部分機構我們學到了非常的多，但我們也發現我們機器人優勢的地方，在最初設計的時候本組就以機構穩定為設計理念，雖然重量會因為為了穩定性而加重，但為了機構的穩定性這點犧牲是值得的，在場也發現其他學校部分機構行走的時候晃的非常厲害，在這方面也有其他組別誇讚我們的機構很穩。比賽到場時也才知道其他組別選用的馬達比本組小非常多，本組的重量有一半是在馬達跟電池上，這點我們進步的空間還很多。這次比賽各組的創意跟機構設計都非常的特別，讓我們學到了特別多，也讓我們在以後設計機構方面有非常多效法的地方。

III、Competition experience

This competition is our first competition, but did not slack off the idea, to the scene after a foot institutions other schools design speed is very fast, and found that our initial foot design, there are some problems, in this part of the institutions we have learned very much, but we also found a place of our robot advantage, originally designed when the group of institutional stability design concept, although the weight will be heavier for stability, but to institutionsstability of this sacrifice is worth it, but the presence of other schools in parts of bodies when walking Akira very powerful in this regard, there are other groups praise our organization is very stable. When the scene also learned that other groups of selected motor than the very large group of small, half of the motor with battery, we progress space is also a lot of the weight of this group. The game group creative with institutional design are very special, and we learned a particularly large design agencies in the future, we have very much to follow the example of places.