

資工專題競賽 創意滿點

文稿整理／王艾妮

資訊工程學系一年一度的專題競賽在大學部同學踴躍參與下已圓滿落幕！專題競賽一直以來都是同學們展現專題課程研究成果、發揮創意、互相交流的活動，也強化了資工系同學們的凝聚力，同學們一起互相討論及參與都帶來無比的成就感。在授課老師林盈達教授及各專題指導老師的鼓勵下，本次競賽共 10 組報名參賽，感謝各位同學踴躍參與，讓專題競賽變得更豐富有趣。

本次初賽於 109 年 11 月 25 日於工三館大廳舉行，初賽隊伍共 10 組，共 6 組進入決賽。決賽於 12 月 23 日舉行，經過同學精彩的報告和展示後，最後產生特優 1 組（獎金每組 15,000 元）、優等 2 組（獎金每組 10,000 元）、佳作 3 組（獎金每組 5,000 元）。以下是各組得獎作品介紹：

特優：在 P4 交換機上支援 Per-flow Fair

Queueing

學生：孫呈佑、蕭宇辰

指導教授：王協源

當 TCP 與 UDP 在競爭有限頻寬而發生封包遺失時，TCP flows 會因為壅塞控制機制將自己的傳送速率降低，而 UDP flows 則是會以相同傳送速率不斷擠壓 TCP flows。最糟的情況是當 UDP flows 的傳送速率超過整個通道頻寬時，TCP flows 會因為不斷遺失封包而將自己的傳送速率降低到幾乎為零的速率，使得 TCP flows 的使用者所分配到的可用頻寬相較 UDP flows 非常不公平。我們利用 P4 交換機設計並實作一個系統保障所有 flows 皆能公平使用頻寬。

優等：CAMPUS- 校園群眾外包系統

學生：郭庭均、李東穎、林彥淳、邱筠絮

指導教授：張永儒

有感於學生這個族群大部分的時間都生活在校園，然而卻經常因為無法得知校園特定地點的即時狀況，因而造成生活上的不便。此外校園中對於無障礙/友善設施或是空間需求的使用者，在取得校園中相關資訊時也都有許多困難，且相關資訊可能無法獲得即時性的更新。為了讓生活在校園中的人們可以得知特定地點的資訊，我們設計了 Web-Based 的校園即時回饋平台，透過群眾外包 (Crowdsourcing) 機制，校園內的每個人都可以在 CAMPUS 地圖上標註值得被分享的資訊，每位使用者是資訊需求方，同時也都是資訊提供方。透過協作的方式，來達到校園地點資訊



的即時與統一性，以及地點呈現的直觀性。

優等：分散式網路服務架構

學生：簡志璋

指導教授：吳育松

NoXerve 是一個分散式網路服務架構，目標是提供標準化且適當抽象化的功能，讓開發者可以免去許多底層機制例如連線的煩惱，充分利用分散式的優點（例如可以 scale up 計算能力、儲存空間等）輕鬆的開發服務與應用程式。並且可以結合為服務的概念，各服務可以各自維護、開發、部屬。

佳作：應用類神經網路於角色運動控制

學生：蔡承恩、陳俊惟

指導教授：黃世強

電腦動畫無論是在遊戲動畫又或是電影產業都相當的盛行。我們參考相關的論文中，發現一篇論文，作者是利用類神經網路的計算與技術，除了讓玩家操控角色產生動作外，也同時處理角色腳步不會穿過凹凸不平的地面。而我們的專題，則是將作者所開發的技術，加入多個角色，模擬彼此間相互互動的情景。

佳作：使用 SAT 演算法完成 PCB 非曼哈頓同步步離繞線之研究

學生：郭家佑

指導教授：李毅郎

傳統 PCB 的逃離繞線與區域繞線是分開設計，然而同時考量才能有最佳品質。此專題首度利用同時演算法，在執行逃離繞線時也考量到區域繞線的品質，從而達到比商業軟體與先前學術研究成果都還要優良的繞線品質。內容為 45 度逃離繞線 MAX-SAT 的 clause 設計，以 concurrent 的方式完成合法的 non-Manhattan PCB 逃離繞線。

佳作：物聯網結合物理實驗模擬教學

學生：張皓鈞、謝昕辰

指導教授：林一平、鄭昌杰

使用物聯網平台 IoTtalk 將手機陀螺儀與網頁上的物理模擬實驗結合，打造出適合中學生的互動式物理實驗模擬教材。

最後，十分感謝授課教師邱維辰教授與所有評審委員（本系吳凱強教授、魏群樹教授）的協助，讓本次專題競賽圓滿落幕。



Computer Science Project Contest: Innovation Everywhere

The annual Project Contest, held by the department of Computer Science, has ended successfully with many active undergraduate participants. The Project Contest is designed for undergraduate students to present their research results in Project Courses, make innovation, and collaborate with each other. It helped enhance group cohesion among students in the Department of Computer Science, and made students feel accomplished while collaborating with each other. Encouraged by the lecturer, Dr. Ying-Dar Lin, and the instructors of different topics, 10 groups entered this contest. Thank you all for your participation to make the contest more fun and engaging.

The preliminary competition was held on November 25, 2020, in the hall of Engineering Bldg 3. Ten teams competed for six qualified quotas of the final this year. The final was held on December 23, 2020. After judges reviewed great presentations and demonstrations by students, one group was awarded to Special Excellence (a scholarship of NT\$ 15,000 per group), two groups were awarded to Excellence (a scholarship of NT\$ 10,000 per group), and three groups were awarded to Excellent Work (a scholarship of NT\$ 5,000 per group). The works of each winning group are briefed as follows:

Special Excellence: Supporting Per-flow Fair Queueing on P4 Switches

Students: Chen-Yo Sun, Yu-Chen Hsiao

Instructor: Shie-Yuan Wang

Providing per-flow scheduling in switches can isolate the traffic of flows that compete for the bandwidth of a bottleneck link. Since UDP does not use congestion control, a UDP flow can consume all the bandwidth of a bottleneck link without considering its fair share on the link. If per-flow scheduling can be used in switches, a UDP flow whose sending rate exceeds its fair share can be enforced to use only its fair share. Thus, it will not severely harm the achieved throughput of a TCP flow, which employs congestion control and will throttle its sending rate to use the bandwidth left by UDP flows. Although per-flow scheduling has important benefits, due to the high implementation costs with providing per-flow queues in switches, this capability is rarely provided in commodity switches on the market. In this paper, we design, implement, and evaluate our scheme in P4 programmable hardware switches. Our scheme provides near per-flow scheduling in switches without per-flow queues. Experimental results show that our scheme nearly achieves what per-flow scheduling can provide when scheduling the packets of competing UDP and TCP flows.

Excellence: Crowd-Assisted Map Pervasive University Service

Students: Ting-Chun Ku, Dong-Ying Li, Yen-Chun Lin, Yun-Chien Chiu

Instructor: Yung-Ju Chang

Students live on campus most of their time, but often feel inconvenience in their daily life because of being unable to know the real-time situation of a specific location on the campus. In addition, people who have access to barrier-free/friendly facilities or space requirements on campus also have many difficulties in obtaining relevant information that may not be updated in real-time. In order to allow people on campus to get information about a specific location, we designed a Web-Based

real-time feedback platform called CAMPUS. Through the crowdsourcing mechanism, everyone on the CAMPUS platform can mark the information that is worthy of being shared on the map, each user is not only an information requester but also an information provider. Through collaboration, the real-time and uniformity of campus information and the intuitiveness of location presentation are able to be achieved.

Excellence: Distributed Network Service Architecture

Student: Chih-Wei Chien

Instructor: Yu-Sung Wu

NoXerve is a distributed network service architecture. The goal is to provide standardized and properly abstracted functions, so that developers can avoid many obstacles such as connection troubles, and make full use of the advantages of distribution (e.g. scale up computing power, Storage space, etc.) to develop services and applications easily. And can be combined into the concept of micro-service, each service can be maintained, developed, and deployed separately.

Excellent Work: USING NEURAL NETWORK FOR CHARACTER MOTION CONTROL

Students: Chien-En Cai, Chen Jun Wei

Instructor: Sai-Keung Wong

Computer animation is very popular in both the game and film industries. We found a paper in which the author used neural network-like computing and technology to allow the player to manipulate the character's movements while at the same time handling the character's footsteps without crossing uneven ground. In our project, the technique developed by the author is used to simulate interactions between multiple characters.

Excellent Work: Concurrent non-Manhattan PCB routing using SAT

Student: Chia-Yu, Kuo

Instructor: Yih-Lang Li

Conventional PCB escape routing and area routing are designed separately. However, the concurrent ways can optimize the quality. In the project, the concurrent algorithm is used to improve the quality of the area routing while the escape routing be executed. Also, it achieves better routing quality than commercial software and previous academic research results. The project is about design of 45-degree escape routing with MAX-SAT, completing the legal non-Manhattan PCB escape routing concurrently.

Excellent Work: Interactive physical simulation with IoT technology

Students: Hao-Chun Chang, Hsin-Chen Hsieh

Instructor: Yi-Bing Lin, Chang-Chieh Cheng

Using IoT technology combines smartphone's gyroscope and physics simulation animation on websites. And design an Interactive physics teaching material for high school students.

Finally, I would like to thank Professor Wei-Chen Chiu and all judges, Professor Kai-Chiang Wu and Professor Chun-Shu Wei of the department of Computer Science, for their assistance for making this contest a success.