

# 陽明交大 X 群聯電子實習計劃

文稿整匯／黃之禹



群聯電子成立於 2000 年，總部位於竹南鎮，是一家總部位於台灣的全球領先的快閃記憶體控制器解決方案供應商。群聯潘建成先生是創辦人之一，亦是交大電機與控制工程系研究所校友。

近年來非揮發記憶體儲存方案的崛起，固態硬碟的技術逐漸取代傳統機械式硬碟機，將高容量可靠的儲存方案帶進各式消費電子產品中，如隨身碟、數位相機、智慧型手機等等。此外群聯亦與國際儲存大廠 Seagate 合作，推出全球最快 PCIe Gen4 SSD 控制晶片、世界首款 SD Express 卡、全球首款通過 SDA SVP 驗證 SD Express 方案等。在人工智慧的浪潮下，快閃記憶體挾其高容量高可靠性的特點，成為克服記憶體之牆 (memory wall) 的關鍵技術，讓大型語言模型訓練過程所需的大量權重參數得以高速存取，將大型模型訓練的計算成本縮減，使各企業在大型模型訓練上能擁有完全的主導權。

快閃記憶體儲存控制器除了微控制器的架構設計之外，實際上更需要高效率的演算法來駕馭這些硬體元件。其中牽涉的技術包括資料結構、演算法、計算機組織、作業系統等等的背景知識，並需要融會貫通克服記憶體的各種限制。群聯研發部門中，有很大一部分比例的人員負責演算法的開發。

為了讓陽明交大資訊學院的同學了解群聯電子的工作內容，自 111 年起，群聯電子與資訊學院便開始進行長期實習計畫。不同於以往暑期短期實習，此實習計畫通常以一學期或者一學年為期，並在資訊學院就地進行，實習期間提供優渥的實習獎助金。工作內容從背景知識的學習、演算法設計與模擬、到實際硬體環境開發測試等等，實習由資訊學院專任教授 (目前為張立平教授) 與群聯主管雙軌指導，透過定期的視訊會議，深入學習韌體演算法開發以及快閃記憶體特性的

知識。實習計畫開辦以來，參與的同學已有 11 位之多，同學們透過實習計畫，不但能加強個人求職履歷的可看性，亦能與業界技術脈動保持即時的接觸。以下為參與實習同學的心得分享：

楊立嘉同學心得 2023/9-1 ~ 2024/5 : 參與群聯實習中，並非一蹴而就，而是透過紮實的基礎建設，讓我在一年的歷程中逐步茁壯成長。一開始，我們從閱讀優秀的論文開始，逐漸積累背景知識；接著，我們勇於嘗試，自行實作了一份簡易的 FTL (Flash Translation Layer) 模擬器；最後，我們深入研究了完整的 SSD 開發環境，並提出了自己的改進方案。這一切，由淺入深，步步為營。在這個過程中，我收獲了豐富的支援與指導，不管是教授還是群聯的主管，都積極地為我們提供協助。更難能可貴的是，我們有機會進群聯竹南公司，親身體驗一家大型企業的運作模式，深入了解各部門之間的協作與配合。總體來說，這次實習不僅讓我累積了硬體相關的知識和實務經驗，還擴展了我的產業視野。而每週兩天的工作安排，也未給學業帶來過多的壓力，相反地，它為我帶來了一段充實而有趣的實習體驗。

魏翌丞同學心得 2022/03 ~ 2023/01 參與群聯的實習計畫讓我深入了解許多學過的演算法是如何應用在實際產品上。通過實作，讓我理解到演算法的開發不同於課堂作業，必須考慮到有限的硬體資源，權衡空間以及時間去設計出可行的解決方案。這次實習不僅讓我學會如何讀懂大型專案，還提升了整理文件的能力。最重要的是，我能夠更深入地了解 SSD 內部的韌體演算法，這對我的專業知識和實作能力都有很大的幫助。

有興趣加入群聯實習計畫窗口資工系黃之禹小姐：haungcy0512@nycu.edu.tw

群聯計畫執行張立平教授：lpchang@cs.nycu.edu.tw

# NYCU X Phison Internship Program

Phison Electronics, established in 2000 and headquartered in Zhunan, is the global leading supplier in flash memory controllers and storage solution in Taiwan, which was co-founded by Mr. Khein-Seng Pua, an alumnus of the Institute of Electrical and Control Engineering at National Chiao Tung University.

In recent years, non-volatile memory storage solutions have become more prevalent, gradually replacing traditional mechanical hard drives with solid-state drives (SSDs). This shift has brought high-capacity and reliable storage options to various consumer electronic products like USB flash drives, digital cameras, and smartphones. Additionally, Phison has teamed up with the global storage leader Seagate to launch the world's fastest PCIe Gen4 SSD controller chip, the first SD Express card, and the first SD Express solution to pass SDA SVP certification. With the rise of artificial intelligence, the high capacity and reliability of flash memory have become essential in overcoming the memory wall. This technology enables high-speed access to the extensive weight parameters needed for training large language models, thus reducing the computational costs of training large models and giving enterprises complete control over the process.

In addition to the architectural design of microcontrollers, efficient algorithms are more critical for optimal management of the hardware components of the flash memory controller. This requires expertise in data structures, algorithms, computer organization, operating systems, and related fields, all of which need to be integrated thoroughly to address various memory constraints. Within the Phison R&D department, a significant proportion of engineers are dedicated to algorithm development.

Since 2022, Phison has partnered with the College of Computer Science at National Yang Ming Chiao Tung University to introduce students to Phison's operations. This extended internship program, unlike short-term summer internships, typically spans one semester or an academic year and takes place on-site at the College of Computer Science. Participants receive significant stipends during their internships. The program includes learning foundational knowledge, algorithm design and simulation, and practice of hardware development and testing. Supervision is jointly provided by Professor Li-Ping Chang of the College of Computer Science and Phison executives. Regular video conferences enable participants to delve into firmware algorithm development and the characteristics of flash memory. Since its inception, the program has involved 11 students. Through this

internship program, students can enhance the appeal of their resumes and maintain real-time contact with industry trends. Below are the experiences shared by the participating students:

The experience of Lijia Yang 2023/9-1 ~ 2024/5: During my time with the Phison internship, I experienced steady growth, built on a strong foundation over the course of a year. We began by studying exemplary papers to accumulate background knowledge. Next, we took the initiative to create a basic Flash Translation Layer (FTL) simulator on our own. Finally, we explored a complete SSD development environment and developed our own improvement proposals. This progression from fundamental to advanced tasks was both gradual and methodical. Throughout this journey, I received considerable support and guidance from both professors and Phison supervisors. It was even more valuable to have the opportunity to visit Phison's Zhunan office, where we gained firsthand experience of a large enterprise's operations and learned about inter-departmental collaboration. This internship not only enriched my knowledge and practical experience in hardware but also broadened my industry perspective. The two-day workweek schedule was manageable and did not impose excessive pressure on my studies, providing a rewarding and engaging internship experience.

The experience of YiCheng We 2022/03 ~ 2023/01: Participating in Phison's internship program helped me gain valuable insights into the practical application of the algorithms I had studied. The hands-on experience demonstrated that developing algorithms differs significantly from classroom exercises; it involves managing limited hardware resources and balancing space and time to create feasible solutions. This internship not only taught me how to handle large-scale projects but also improved my documentation skills. Most importantly, it deepened my understanding of firmware algorithms in SSDs, greatly enhancing both my professional expertise and practical abilities.

For those interested in joining the Phison internship program, please contact Computer Science department Ms. Chih Yu Huang haungcy0512@nycu.edu.tw

Professor Li-Pin Chang lpchang@cs.nycu.edu.tw is responsible for overseeing the execution of the Phison program.