

計畫成果摘要報告表

1. 計畫成果綜合摘要-Report：

(1) What-計畫成果說明：

本計畫共錄取兩位來自越南胡志明工業大學(Industrial University of Ho Chi Minh City, Vietnam)電機工程學院的兩名大四學生，由兩校的老師共同指導在台灣期間的研究主題。至台灣實習三個月期間，主要的學習及生活適應配套措施包含學伴的安排、專業技能的學習及養成、台灣產業交流、參加國際規模產業展覽、文化交流體驗及參與國際創新創業競賽。為了加強與合作學校的共授及建立兩校學生的共學環境，由國立宜蘭大學機械與機電工程學系 4 位學生，2 位指導老師，電子系 3 位學生，1 位指導老師及胡志明工業大學 2 位學生，4 位指導老師，共同組成的跨國、跨校、跨系團隊，進行人才培育、共教共學及各種研究及技術的資源整合；參與 2019 TECO Green Tech International Contest，榮獲 Best Technology Award。

參賽團隊師生受胡志明工業大學校長正式邀請，參加兩校在跨國創新創業競賽的經驗分享及雙邊的資源整合研習營。本計劃所完成的研究與參賽的成果未來將進一步落實到當地的產業，並將參賽的相關技術及經驗融入到未來兩校的數位教學課程開發。

(2) When-計畫時間：

2019/07/01 ~ 2019/09/30

(3) Where-計畫執行地點：

國立宜蘭大學 機械與機電工程學系 先進動力與能源實驗室

(4) How-計畫執行方式：

- a. 參與先進動力與能源實驗室的內部訓練課程：包含基礎專業外文、專案管理及成本分析、近代電機原理及應用、高效率電機量測法規及實作、工業節能技術的原理及實作與電動車動力單元的原理及實習等相關訓練課程。
- b. 專題研究：將依來台蹲點的學生背景，與其指導老師共同討論後決定研究主題，主要為先進高效率電機設計與應用、工業節能技術應用與推廣及電動車動力單元的原理及設計，並以此做為未來雙邊合作研究的主題及來台蹲點學生後續攻讀學位的基礎。
- c. 學生成果的呈現：所有來台蹲點學生的相關研究成果，將參加相關創新創業競賽、研討會或期刊發表，藉此加強學生的表達及自信與成就

感。

- d. 移地教學：透過與台灣產業交流、參加國際規模產業展覽及參與國際創新創業競賽的觀摩，強化來台蹲點學生對台灣教育、產業、經濟及文化的了解，期許未來能以台灣做為未來攻讀學位或經貿發展的亞洲首選伙伴。

(5) Who-計畫實習名單

本計畫預計招收蹲點學生人數為 2 人/3 個月，共有 25 人申請，包含印度、越南、巴基斯坦及尼泊爾等國家。最後，錄取越南胡志明市工業大學(IUH) 電機工程學院大四學生 Nguyen Luong Vinh、Duc-Trong Bui，在台實習時間為三個月。

(6) How Much-計畫收支結算

TEEP@AsiaPlus 收支結算表 (本計畫核定金額 7.5 萬元整)		
A.TEEP 外國青年學子獎學金：每人補助\$12000/月		
姓名	來台停留月數	補助金額
Bui Duc Trong	3	\$36,000
Nguyen Luong Vinh	3	\$36,000
Total		\$72,000
B.學生耗材使用費(研究及實驗材料費)		\$3,000
總支出:A+B=\$75,000		

2. 蹲點成員表現-Performance of TEEP Students

(1) 計畫成果影片：

<https://youtu.be/A3ZY0M92MpY>

<https://youtu.be/aPRap7fk1SM>

<https://youtu.be/oe5pDhlh3a8>

<https://youtu.be/SXgBE79oCPs>

(2) 蹲點成員成果：

Name	Nguyen Luong Vinh	Email	nguyenluongvinhho@gmail.com
	Duc-Trong Bui		ductrong.play2.fc@gmail.com
Advisor	Professor. Cheng-Hu Chen, Professor. Ruey-Yue Lin		
Title	Intelligent Energy Saving Vacuum Pump Power System		
<h2>Research Process</h2>			
<h3><u>Introduction:</u></h3>			
The world energy consumption will increase by more than 40% in 2035. The energy sources is not			

enough ability to supply for this demand, considering the side effects and limitation of fossil, nuclear, and renewable energy, we could not find a perfect solution for electricity generation up till now, which means energy saving becomes an important issue to concern in the globe.

Unlike the other traditional manufacturing industries, the vacuum environment is required in most of the processes of the semiconductor manufacturing industry, namely, vacuum pumps play an important role. According to the feedback from end-users and manufacturers of vacuum pumps, the major problems of the current solutions including, relatively low efficiency, too many frame sizes of the power units, high maintenance cost, and the working conditions of the machine could not inform the end-users and manufacturers immediately and simultaneously.

Experiment:

We improve the efficiency of the power unit of vacuum pumps. By abandoning the traditional induction motors and permanent magnet synchronous motors, a high efficiency magnetless synchronous motor is developed, the new design can be produced by the current manufacturing facilities. Moreover, it does not require the use of rare earth materials and energy consumed the die-casting process. Before to install the motor into the vacuum pump, the new motor is evaluated by the motor measuring technology to verify the required performance.

In addition, we also develop the mobile intelligence monitoring platform and the concept of IoT is introduced which achieves real-time data display and automatic data collection, includes motor voltage, motor current, motor power, water chiller unit power, vacuum degree, flow ratio, temperature of different parts of the system, etc. Measured data from sensors and controllers are transmitted to the PLC with RS485, then uploads them to the server, finally, the data is transmitted to the database on cloud simultaneously, and users can download the data from the cloud and transmit the ordered data from the server to users' applications. All the hardware and software were developed by team members since the news of the contest was launched. From above factors, they are convenient for enhancing production line management and integrating data analysis and improve the foundation of productivity and reliability.

Results:

The major contribution of this project includes two main parts:

- (1) High efficiency magnetless synchronous servo motor and control system uses inverter, which can reduce the energy consumption up to 40%.
- (2) Intelligent real-time on-line data collection system, the proposed mobile intelligence platform can provide current working conditions of the vacuum pump and the historical data of the vacuum pump. This helps the users to have clear awareness about the conditions of machines and determine the need for maintenance or replacement. Finally they improve the reliability of the production line.

With this project we join in the Green Tech 2019, TECO International Contest, and achieve the prize: Best Technology Award By Creative Sensor Inc. It is a worthwhile result for all lab members. This result will be platform for new international contests in the future.

Taiwan Internship Experiences Experience

Nguyen Luong Vinh

I'm the junior student of Industrial University of Ho Chi Minh city. My major is Automatic Controlling Technology Engineering. In summer 2019, I have an opportunity to join the Taiwan Experience Education Program (TEEP) at National Ilan University (NIU) for 3 months.

Every day working at APEC with my friends and Prof. Chen is a new experience, new knowledge for me. I have been taught about a professional working environment and opened as well. Everyone knows clearly about their tasks and goals with the high spirit, such a great honor to work in this such kind of style.

Prof. Cheng-Hu Chen, he is the one gave us this opportunity to be here for 3 months, the favor of him is so huge to me, thanks are never enough, the only way I can pay for that is working hard, trying my best to not let him down and this is a great honor for me to work with a great teacher like him. There are many member in APEC I want to tell about, but words are not enough, everyone is a piece of the beautiful picture of the memory that I had in these 3 months.

Duc-Trong Bui

During these three months of internship program, I learned many research skills and developed myself through day by day. To start any researches, firstly I have to get a clear goal, then arrange a time to complete this goal, a great goal will give you a straight line to keep attention during the whole research process. In addition, writing the research diary every day which helps me to monitor my daily work, keep up the plan, and make time valuable. We also usually organize lab meetings in which every lab members can present their research progress and then discuss complex problems to find the best solvation together. Not only about the research methodology, I also developed my English skills, communication skills, lab maintenance, etc. Certainly, those skills are very helpful for my next researches as well as a future job.

I thank the Taiwan Experience Education Program (TEEP@AsiaPlus) and National Ilan University funded by this opportunity. Also, I am very happy when working with laboratory members and Taiwanese students, who have always been supportive and helpful towards me. Finally, I am grateful to Prof. Cheng-Hu Chen, who gave this chance to me to go to Taiwan in 3 months, improve my knowledge, research experience as well as complete this wonderful internship.

(3) 計畫成果圖文說明



實驗室每週舉行研究會議



實習實作過程



越南老師針對 TEEP 學生研究討論



與 TEEP 蹲點學生進行研究交流



TEEP 蹲點成果



參賽團隊簡報



參賽團隊合影



台越文化交流