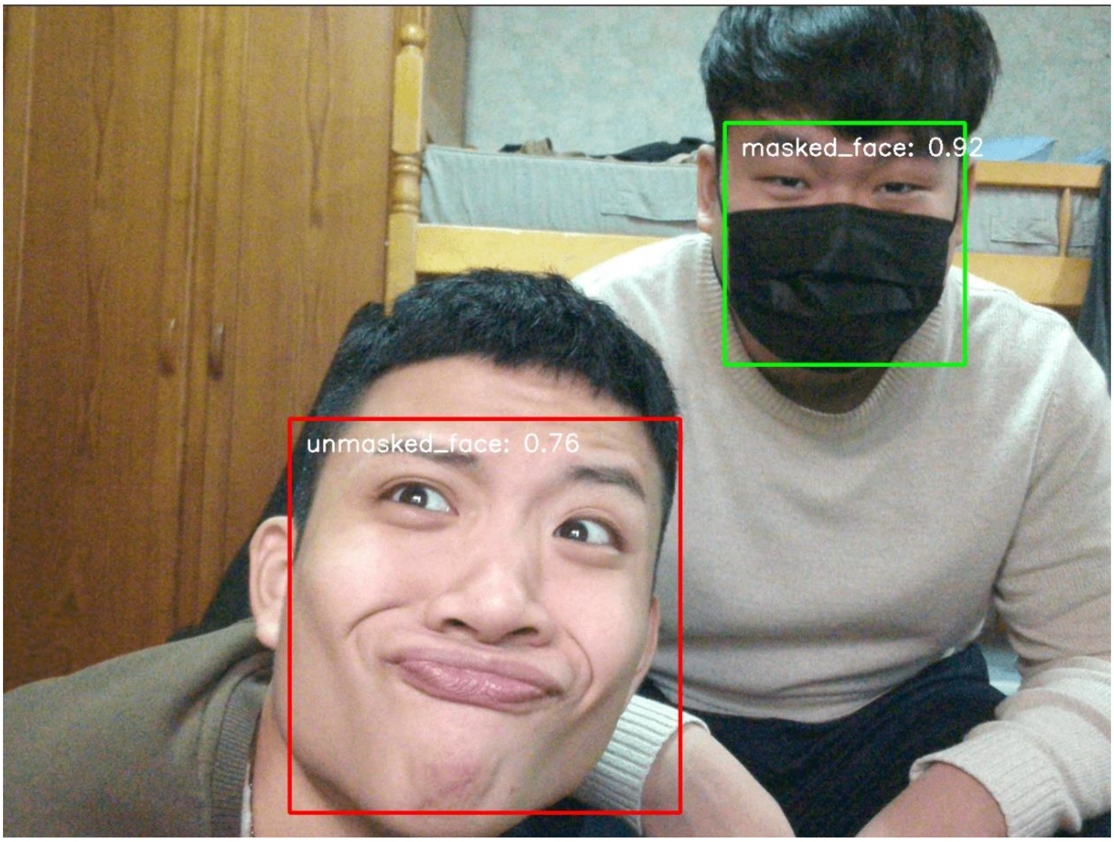
Taiwan Tech has been honored with the College Student Research Creativity Award by the National Science and Technology Council for its outstanding work in the fields of Mask Recognition, High-Entropy Alloys, and Lithium Battery Modification.

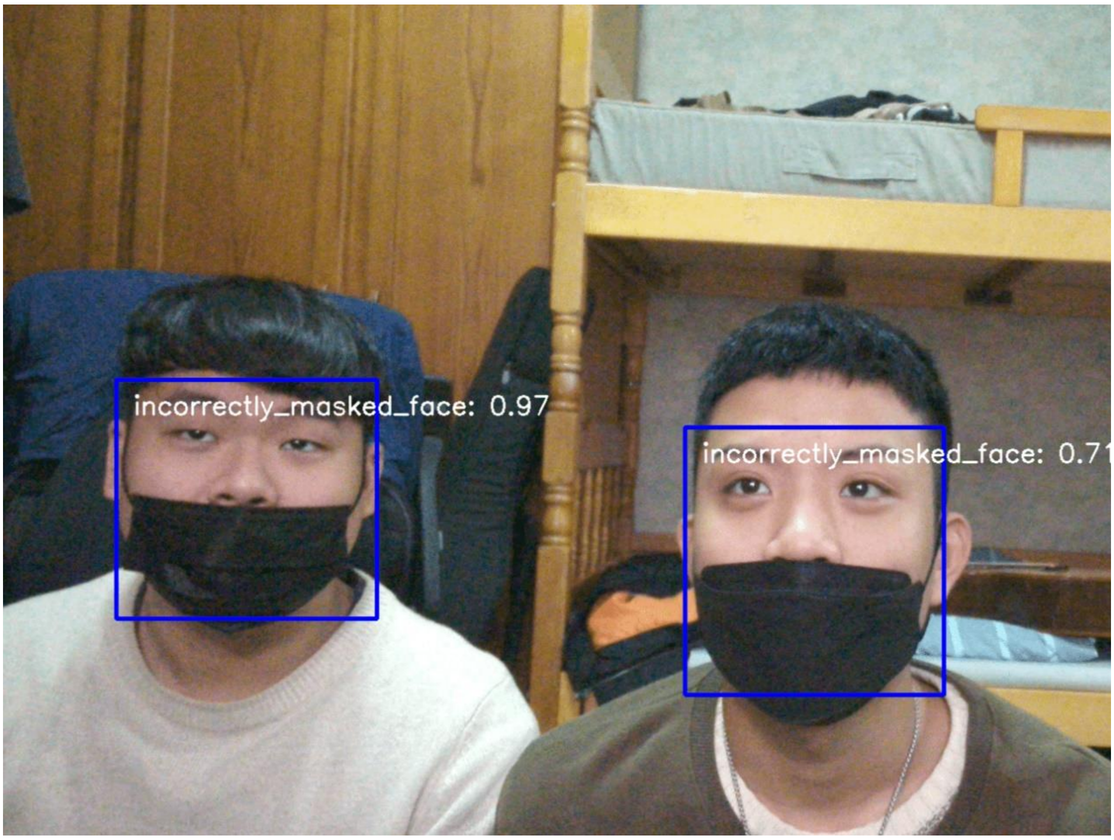
The National Science and Technology Council has recently announced the list of recipients of the "111th College Student Research Creativity Award," and we are proud to announce that three students from Taiwan Tech have been recognized for their exceptional achievements. The awardees are as follows:

1. Yu-Chen Hong, from the Department of Electrical Engineering, for his project titled "Real-time Mask Wearing Recognition System based on Internet of Things (IoT) Services"
2. Zi-Yang Jiang, from the Department of Materials Science and Engineering, for the work on "Interface Reaction of CoCuFeNi High-Entropy Alloys and Sn-based Solder"
3. Jia-Xin Zhang, from the Department of Chemical Engineering, for the work on "Research on Novel Anode-free Lithium-Cesium Bimetallic Battery Electrolyte."

Under the guidance of Professor Jing-Hu Lu, Yu-Chen Hong's project focuses on integrating mask-wearing recognition with an automated reminder system, designed to reduce conflicts arising from mask-wearing reminders. While previous research has utilized AI to recognize whether individuals are wearing masks correctly, there have been limited applications in this area. Yu-Chen Hong addresses this gap by using edge computing devices, such as the NVIDIA Jetson TX2 and the single-board computer Raspberry Pi, to construct a "Mask Wearing Recognition System based on Internet of Things (IoT) Services." This system identifies the mask-wearing status (correct, incorrect, or not worn) and transmits the relevant information to the device end, where voice prompts, or access gates are employed to remind individuals to comply with epidemic prevention measures.



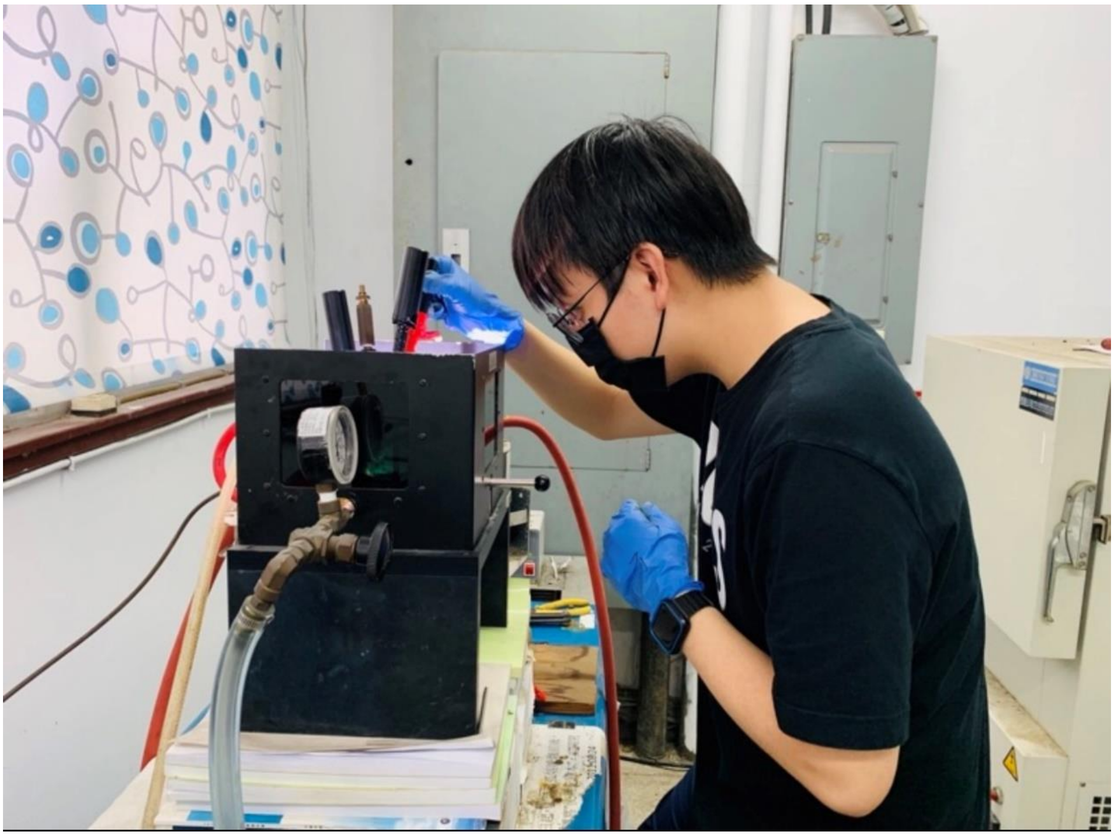
Yu-Chen Hong (on the right) utilizes deep learning networks to perform mask-wearing status recognition and integrates the system with an automated reminder device. Correctly worn masks are identified by green bounding boxes, while red bounding boxes indicate instances of no mask-wearing.



On the left, Yu-Chen Hong utilizes deep learning networks to perform mask-wearing status recognition and integrates the system with an automated reminder device. Incorrectly worn masks are identified by blue bounding boxes.

Yu-Chen Hong explained the integration of current events into his research and engaged in multiple discussions with his advisor, which contributed to refining the architecture design, system functionality, and operation. While the pandemic has subsided, reducing the reliance and mandatory nature of mask-wearing, there remains a need for mask-wearing in places such as hospitals. He believes that the developed system can continue to serve as a practical tool for the future to facilitate the management of personnel entry and ensure the completeness of protective equipment.

Under the guidance of Professor Yi-Wen Yan, Zi-Yang Jiang conducted research in the "Electronic Packaging and Green Materials Laboratory", focusing on the investigation of interface reactions between high-entropy alloys and lead-free solder. The objective was to apply high-entropy alloys, which possess excellent properties, to electronic assembly. High-entropy alloys are composed of five or more metals, with each component not exceeding 35% of the total composition. They exhibit outstanding electrical conductivity, thermal conductivity, and strength. Jiang's experiments focused on the examination of reactions and intermetallics generated at different welding temperatures. The ultimate goal is to use these high-entropy alloys for interconnects in integrated circuits and critical components in chips, replacing relatively weaker copper or copper alloys. This novel research aims to provide valuable contributions to the electronics and semiconductor industries by offering improved performance and strength.



During the experimental process, Zi-Yang Jiang operated an arc melting furnace. His research focused on investigating the interface reactions between high-entropy alloys and lead-free solder, with the ultimate goal of applying these high-entropy alloys, known for their exceptional properties, in electronic assembly processes.

Zi-Yang Jiang has consistently been intrigued by superalloys and aerospace metals, aspiring to develop high-strength and high-ductility metallic materials for widespread applications in daily life. He expressed his enthusiasm for engaging in research at the university level through this project. Under the mentorship of his advisor, he received training akin to that of a graduate student. His participation in academic conferences further enriched his experience, exposing him to cutting-edge knowledge not commonly encountered in regular classrooms. In the future, Jiang intends to pursue further studies in related fields, focusing on the enhancement and development of high-entropy alloys and other metallic materials.

As for Jia-Xin Zhang's project, it revolves around anode-free batteries, aimed at resolving issues related to lithium dendrite formation and lithium dead deposition during the discharge process, which can adversely affect the cyclic lifespan of the batteries. Anode-free batteries belong to the category of lithium-ion batteries and have garnered significant attention in recent years due to efforts to reduce environmental pollution and combat global warming through the active development of renewable energy sources such as electric vehicles and solar power. Lithium-ion batteries, pivotal for large-scale energy storage systems and the propulsion of electric vehicles, have encountered limitations in terms of the energy density due to the certain occupied volume of both positive and negative electrodes. In response, the academic community is working on the development of anode-free batteries with an emphasis on achieving higher performance and enhanced safety features.

Jia-Xin Zhang's project centers on anode-free batteries, with the primary objective of addressing the issues arising during the discharge process, specifically the formation of lithium dendrites and lithium dead deposition, which can significantly affect the cyclic lifespan of the batteries.

Jia-Xin Zhang introduced two types of metal salts, lithium and cesium, into the electrolyte to enhance the deposition and diffusion behavior of lithium metal during the charge-discharge processes in anode-free batteries. The accompanying image depicts a snapshot from the laboratory experiment.

In anode-free batteries, the high reactivity of lithium metal can lead to continuous generation and deposition of lithium dendrites due to its reactions with the organic solvents within the battery, ultimately affecting the battery's lifespan. To address this issue, Jia-Xin Zhang's research focuses on introducing two types of metal salts, lithium and cesium, into the electrolyte to determine the optimal ratio, aiming to ameliorate the deposition and diffusion behavior of lithium metal during the charge-discharge processes in anode-free batteries. As an emerging field, anode-free batteries benefit from the guidance of Professor Bing-Jau Huang, an authority in the battery domain. The laboratory seniors provide valuable insights and offer solutions to address various challenges, significantly contributing to the progress of the research.

To foster the early development of outstanding research talents, the National Science and Technology Council (NSTC) annually solicits research projects from college students. Successful applicants are eligible to receive a research grant of NT$48,000 along with a maximum of NT$20,000 for consumables. Subsequently, the research results are evaluated based on creativity and excellence, and deserving recipients are awarded the College Student Research Creativity Award, which includes a prize of NT$20,000 and a certificate.