About Me +1 6083200818 zqiming@seas.upenn.edu

Ken Zhang's Portfolio

My research and projects

My approach to projects prioritizes being real and meaningful, addressing practical challenges.

I also focus on creating solutions that are both beautiful and sustainable, ensuring functionality, aesthetic appeal, and long-term environmental impact.

University Of Pennsylvania

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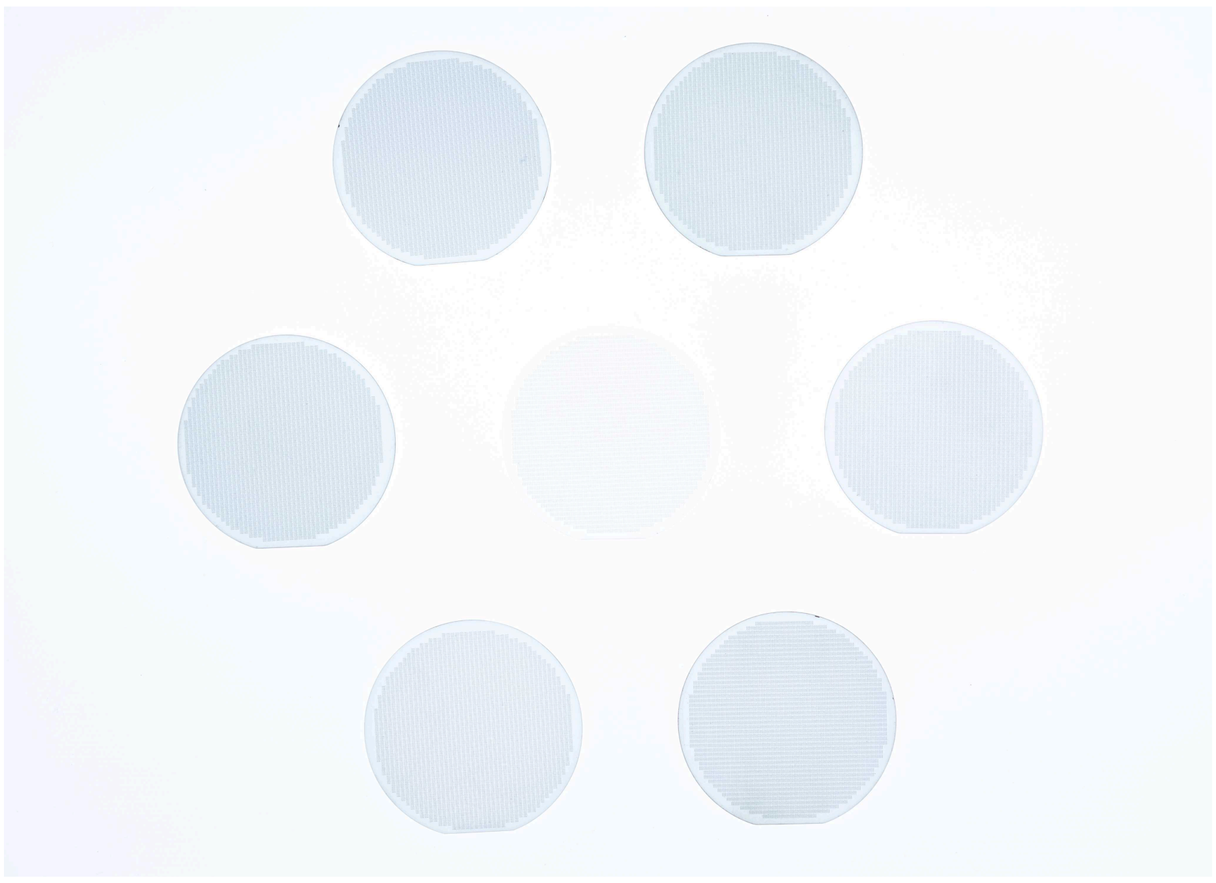
2022 ~2023
My semiconductor research



Silicon Diodes on GaN wafer — Seven wafers come together to form the ring, each has more than 30000 diodes on the wafer

WHAT I DID

During my time at the Wisconsin Nano Device Lab (www.wisned.com), which I joined in March 2022, I engaged in Prof. Ma's research team focused on novel wide band-gap semiconductor fabrication techniques which is using a new "semiconductor grafting" transfer technique to replace the traditional epitaxial growth.

After several months of learning and practicing, I primarily involved the design and development of GaN-based diodes, including fabrication, thermal annealing and testing of 2-inch GaN wafers. This hands-on experience with processes such as lithography, etching, and material analysis deepened my understanding of nano-device fabrication.

Additionally, my contributions were instrumental in a research paper currently submitted for review by Nature.

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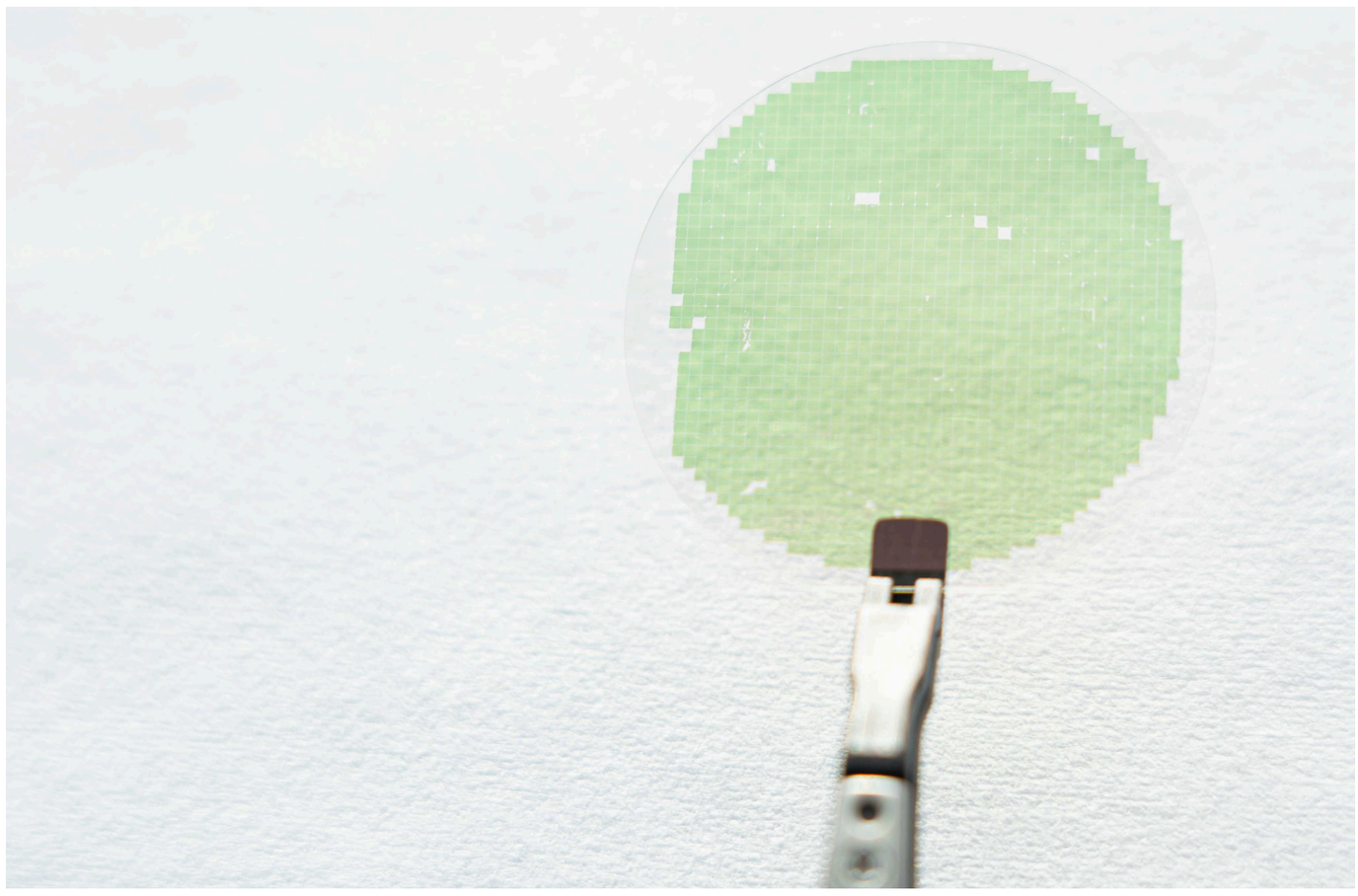
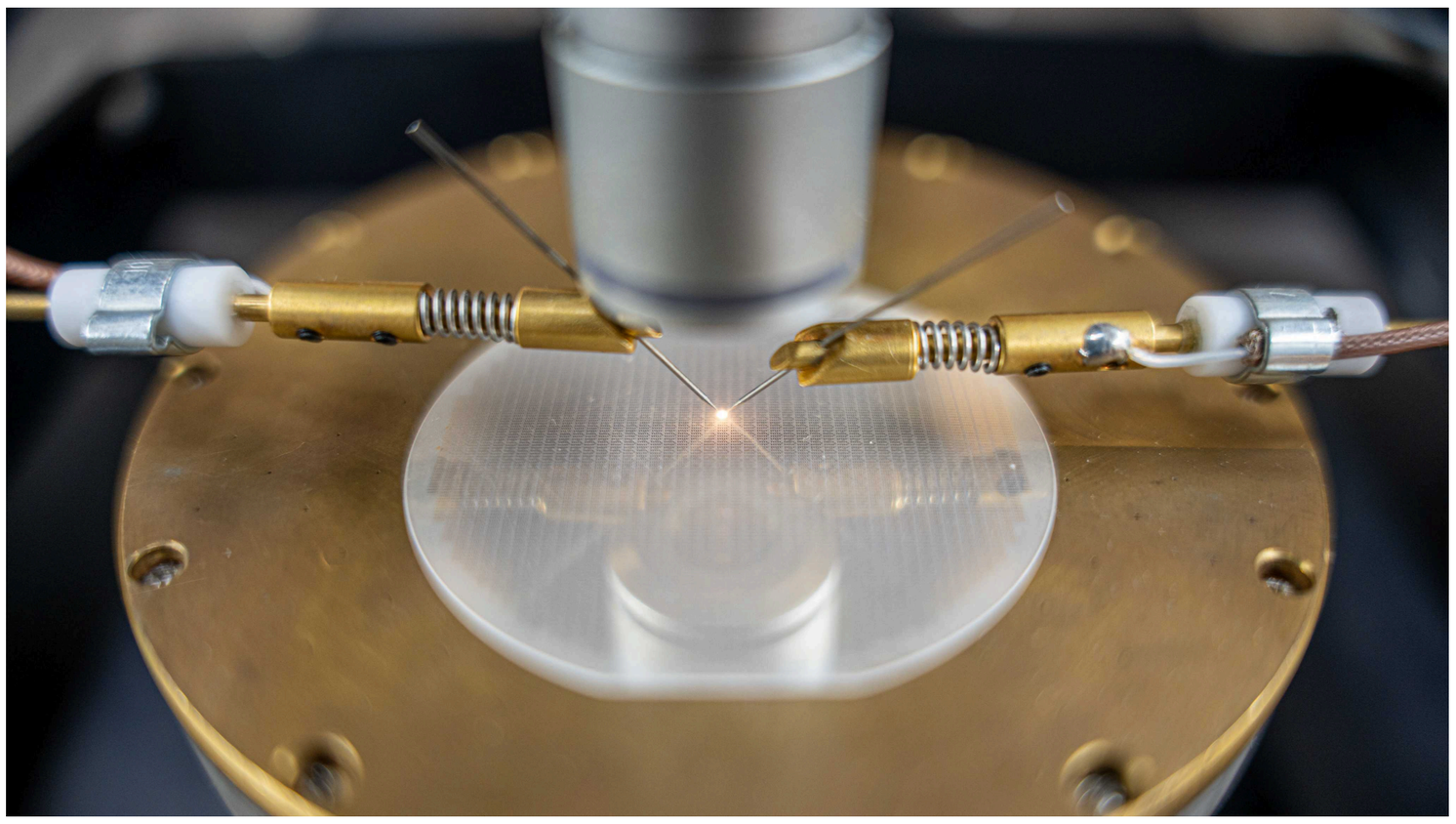


The Transfer Technique — Obtaining a high yield when transferring the silicon membrane onto a GaN base is an extremely delicate and precise task. The difficulty increases exponentially with the size of the transfer.

Wafer testing — Manually testing 1600 uniformly selected devices on the wafers takes hundreds of hours.



WHAT I FEEL

My experience in the lab has instilled in me a deep sense of respect for experimental research. The precision and complexity required in each experiment have made me truly appreciate the responsibility and significance of scientific exploration. At the same time, facing challenges and finding solutions throughout the research process has fueled my passion and desire for innovation. I firmly believe that through continuous exploration and creative thinking, we can drive technological advancements and shape a better future. This pursuit and belief are what motivate me to keep pushing forward.

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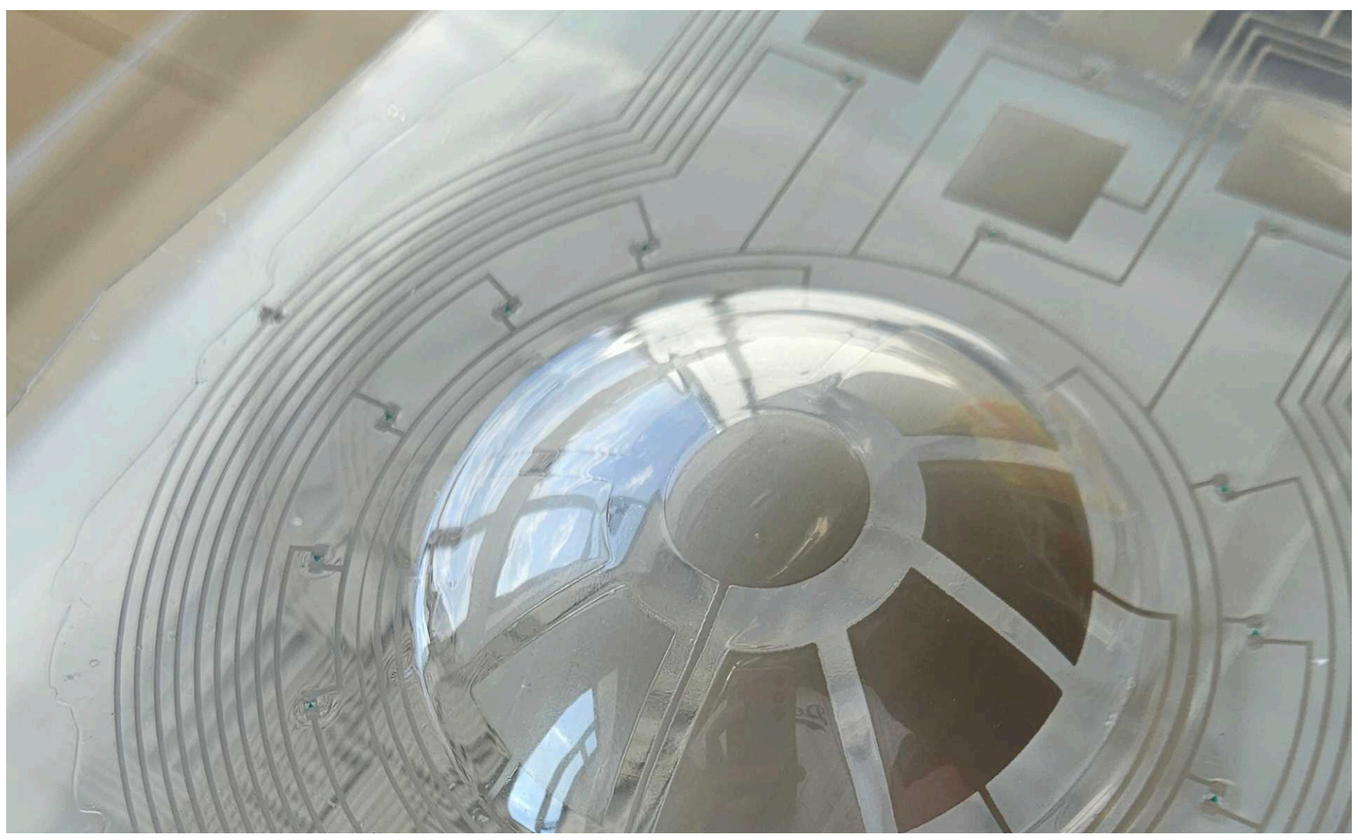
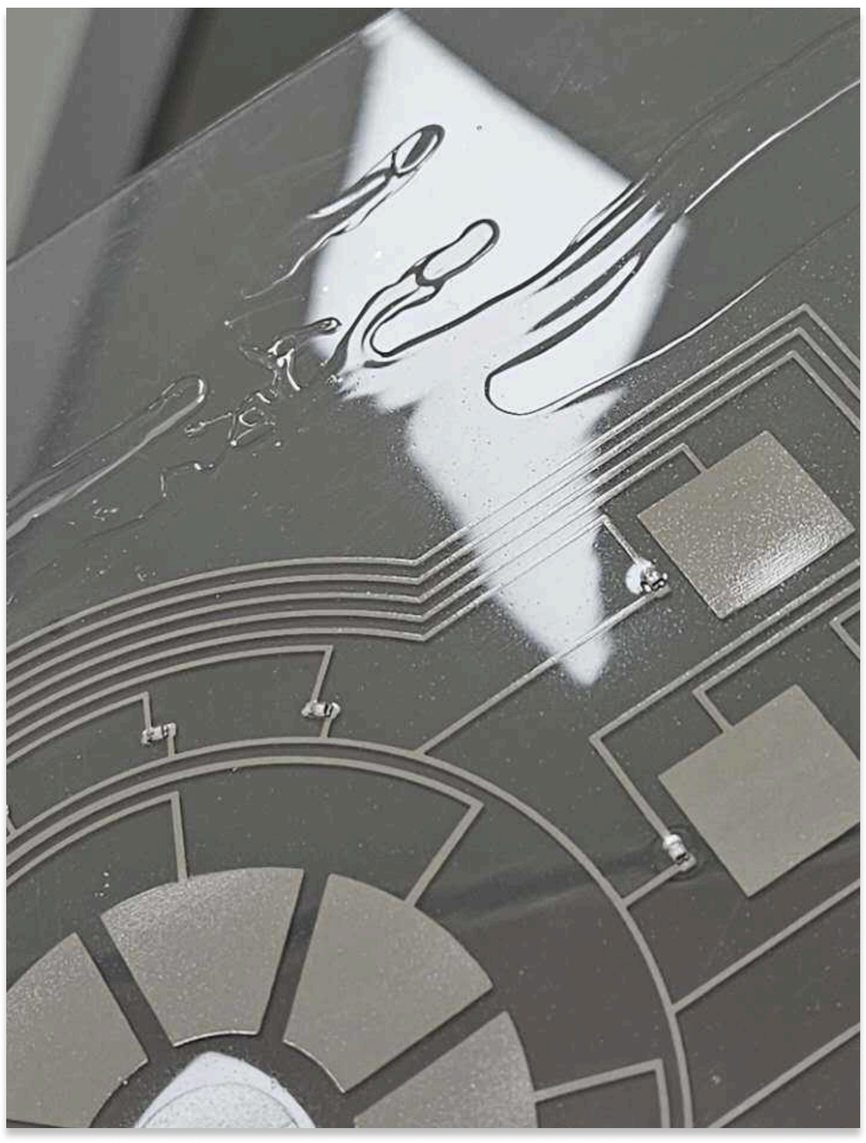
2023 ~2024
Flexible Electronic In-Mold Product



Flexible circuits — The flexible circuit made from stretchable silver paste adheres well to the inner surface of the product, and it retains high conductivity even after being stretched during injection molding.



Packaging — The polymer material was carefully selected after rigorous testing and experimentation with various formulations, ultimately resulting in the optimal choice for encapsulating the flexible circuit.

WHAT I DID

During the summer of 2024, I explored the field of flexible electronics and product development during the intern, particularly focusing on the emerging technology of in-mold electronics (IME).

I initially focused on the design and verification of flexible circuits, working with integrated IME components, which allow electronics to be seamlessly embedded within the surfaces of products during manufacturing. As the project progressed, I took on more responsibilities, including solving challenges related to the integration of conductive inks, electrostatic issues, thermoplastics, and the overall material design for the new product. Additionally, I collaborated with the production team to refine manufacturing techniques and tackled user design challenges to ensure an intuitive and functional product.

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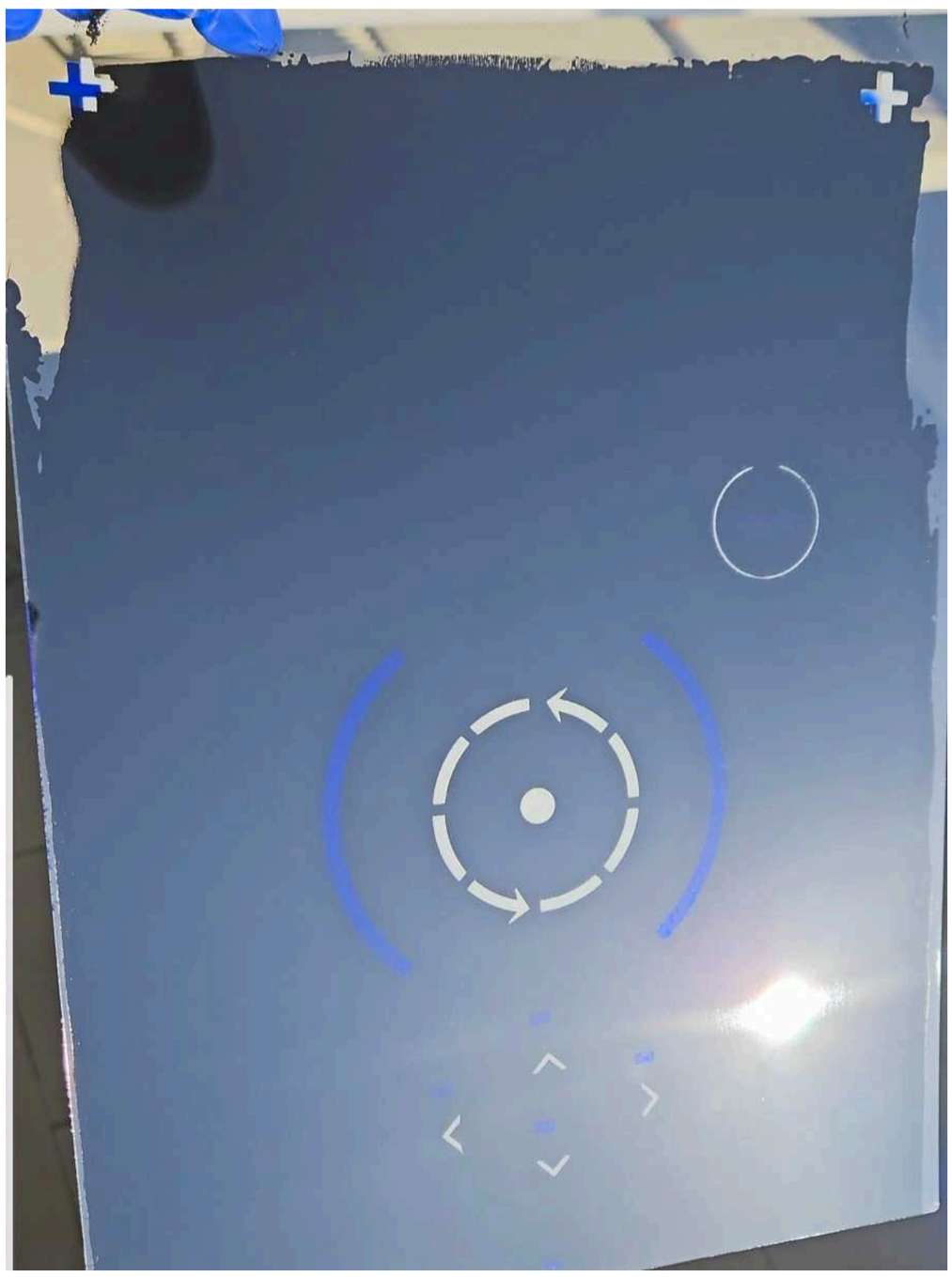

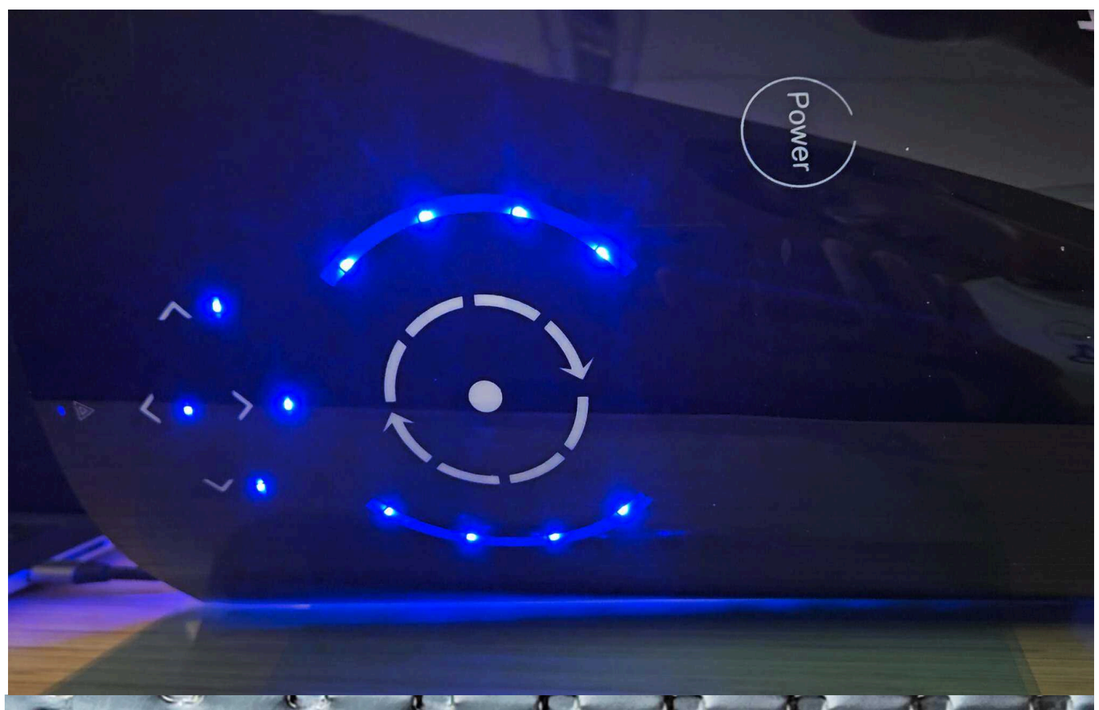

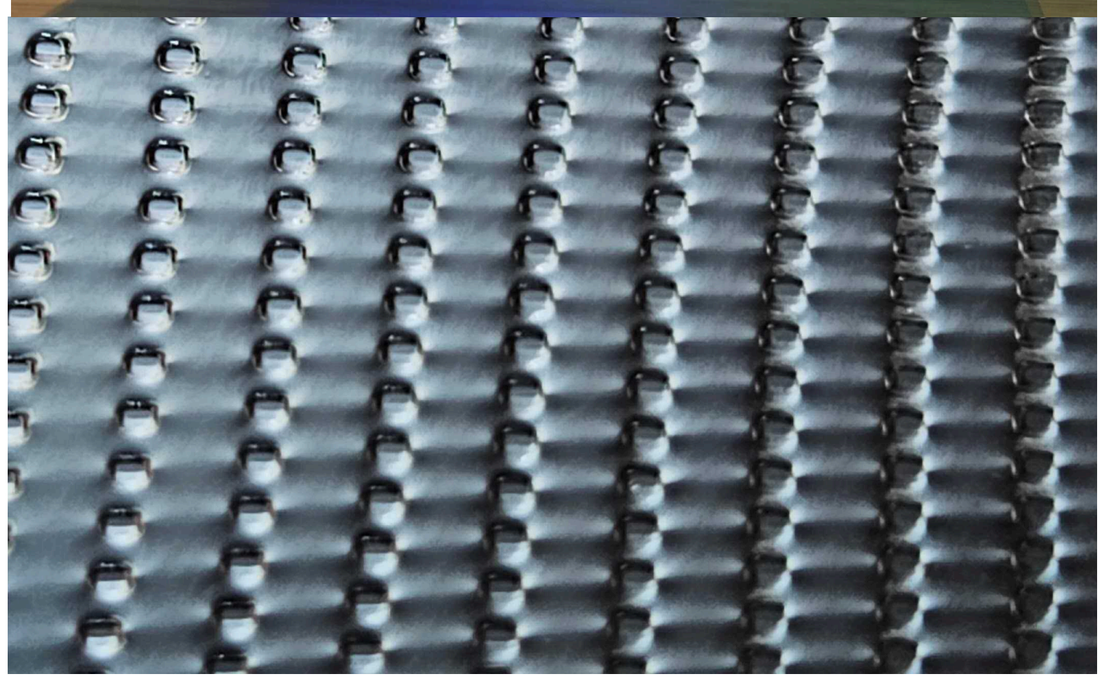

Flexible product— After applying the decorative coating, the product was successfully powered on and demonstrated various functions. I also contributed to the completion of a flexible-rigid polymer substrate project.

WHAT I LEARNED

This experience not only deepened my understanding of product development but also provided valuable insights into the complexities of bringing innovative IME technologies to market.

Beyond the technical knowledge I gained, this internship also significantly enhanced my leadership skills. One of the key challenges was overseeing the printing of multi-layer flexible silver paste circuits. To overcome this, I led two interns who initially focused on material research, guiding them through the process of material selection and production while ensuring the project's requirements were met. Additionally, I was entrusted with the responsibility of managing part of the team’s budget, allowing me to make procurement decisions directly. By coordinating the team's efforts and making strategic decisions, we successfully completed the printing and implementation of the in-mold flexible circuits, delivering a key part of the project on time.

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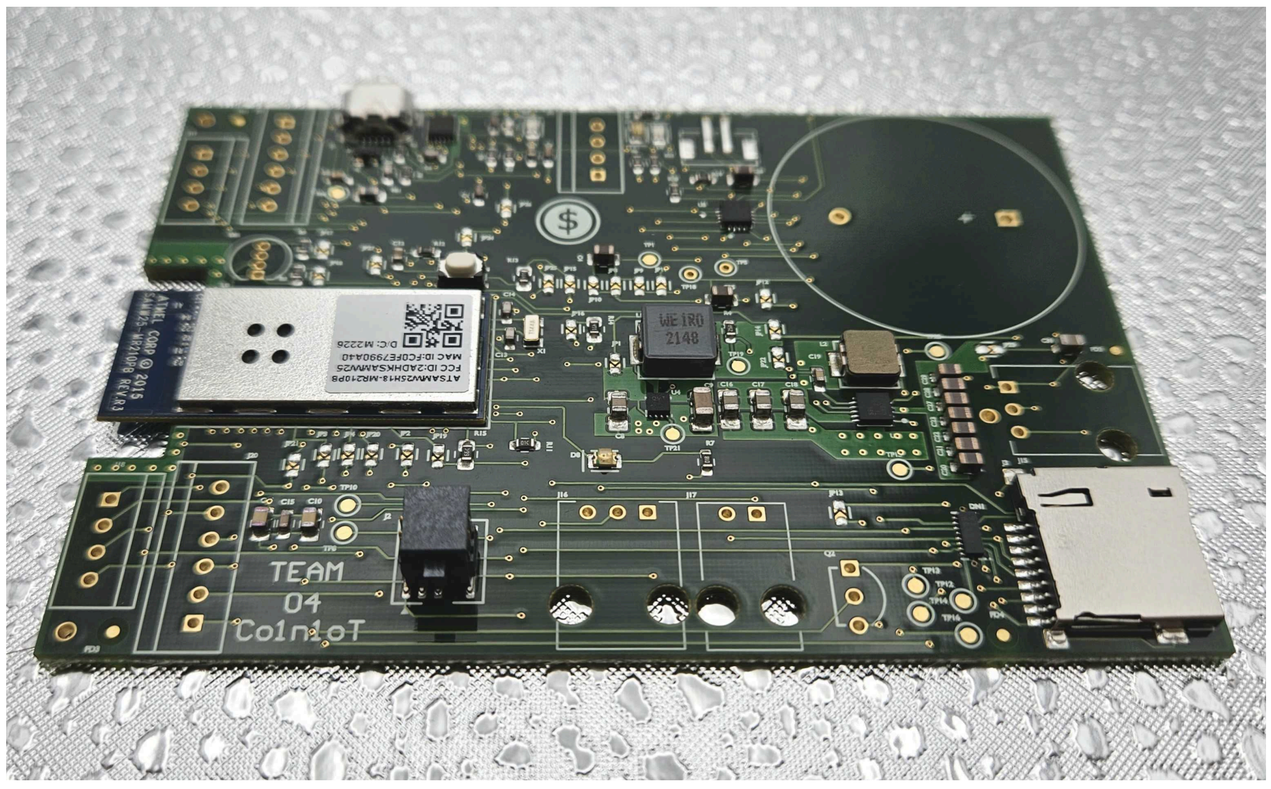
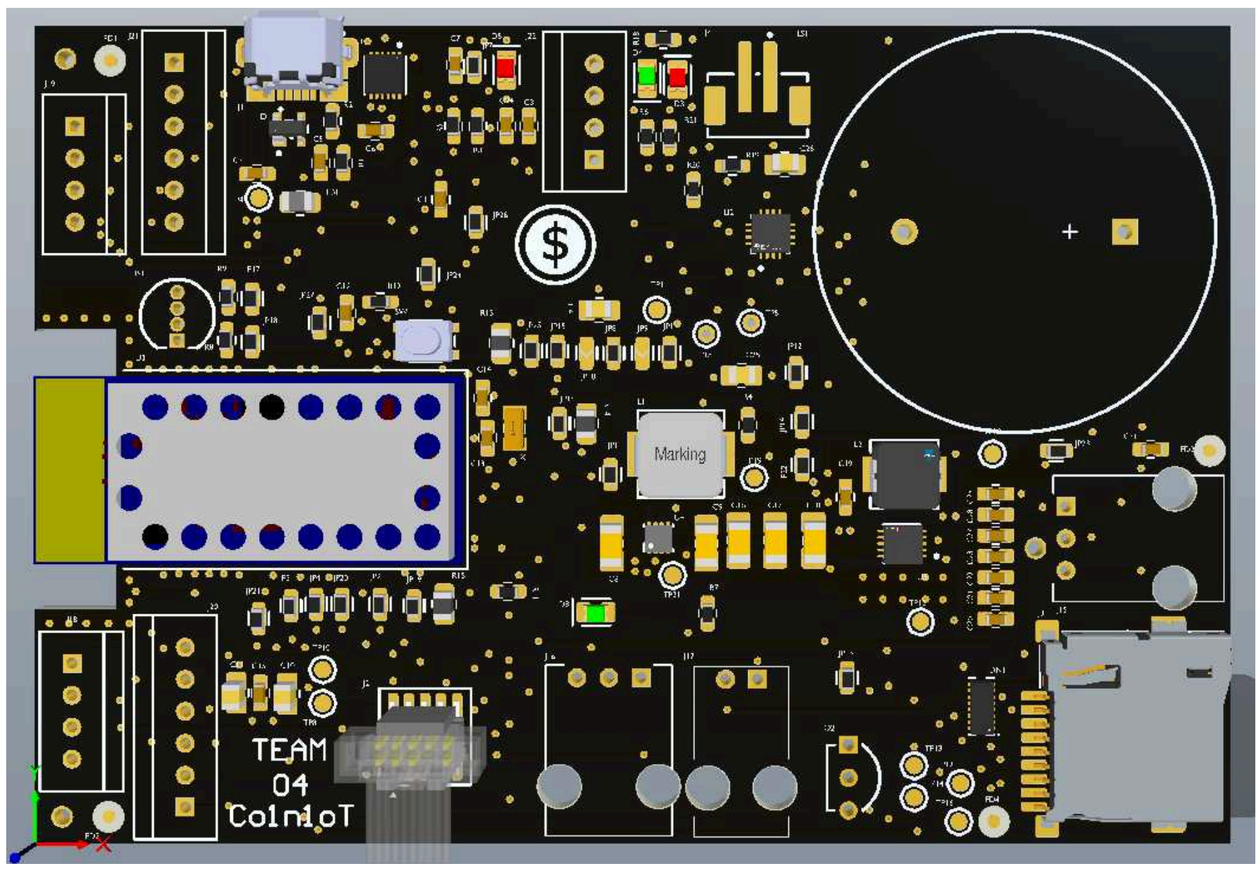
2023 ~2024
My Embedded IoT PCB design





Flexible product— The IoT PCB schematic and the actual product images

WHAT WE DID

In my IoT Piggy Bank project, I led the design and development of a smart savings device that integrates IoT technology into a traditional piggy bank. I designed the 4-layer PCB using Altium, incorporating coin recognition sensors, a SAMW25 MCU, and wireless connectivity modules. The firmware, developed using Microchip Studio and FreeRTOS, managed real-time operations, including sensor data collection via I2C, SPI, and PWM. The device connected to a cloud server using Mqtt and Azure, syncing savings data to a mobile app created using NodeRed, where users could set goals and monitor their progress.