



AIoT and LLMs in Industry/Agriculture Applications

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Outline

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- Where is the Beef?
- System Integration
- AIoT for Passenger Escalator Safety in MRT
- AIoT for Resolving Human-Wildlife Conflicts
- Conclusions



Where is the Beef?

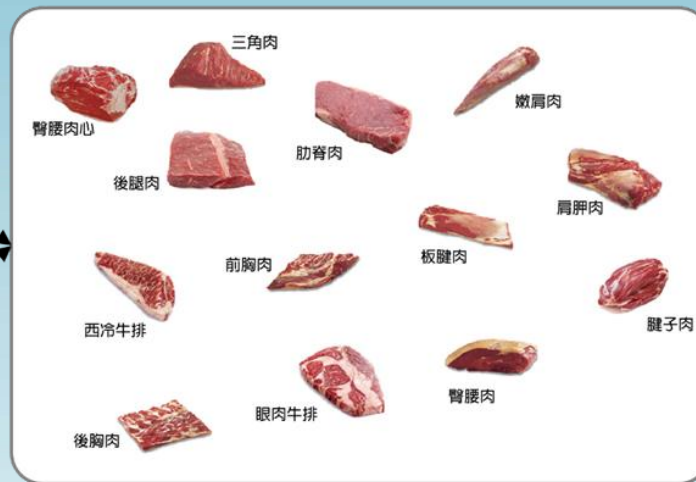
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long-term



short-term



Each one takes what he needs

- Sources:
- https://pngtree.com/freepng/cute-cow-cartoon-clipart_14666897.html
- https://zh.pngtree.com/freepng/vector-illustration-of-a-dairy-cow_18388504.html
- <https://www.materdoor.com.tw/article/66>

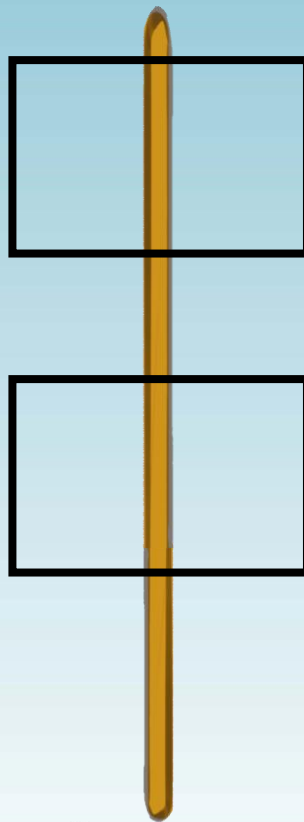


System Integration (SI, 系統整合)

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「串」：Two mouths (口) need a stick to integrate them

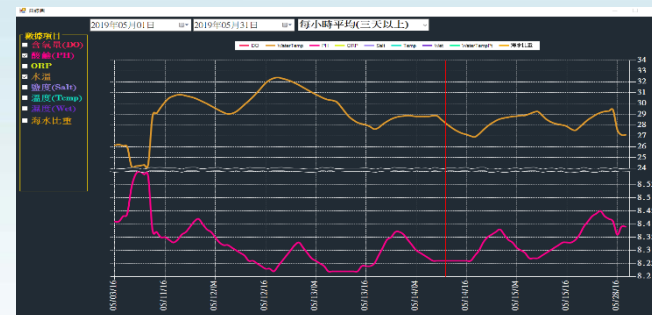
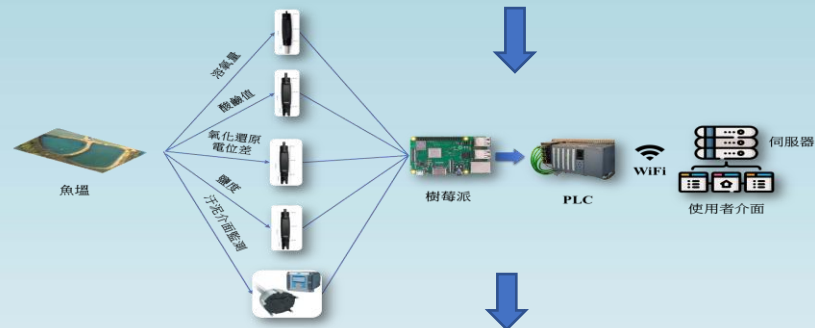
Cross-domain
System Integration
Implementable



AIoT Systems

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AI + IoT: AIoT



Knowledge Learning vs AI

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- Teachers: impart knowledge, teach skills, and resolve doubts (師者：傳道、授業、解惑)
- Learning: helping humanity acquire knowledge
- AI: through learning, it helps humans summarize vast amounts of knowledge and generate various applications
- AI learning process: training, modeling, prediction, decision-making, and execution



What is AI Agent?

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- It is no longer just a chatbot.
- Now, AI models can:
 - ✓ automatically break down tasks,
 - ✓ proactively plan steps,
 - ✓ invoke tools to execute tasks, and
 - ✓ continuously learn and improve.
- From "answering questions" to "completing tasks."



A Giant Step towards AI

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- AI is increasingly resembling human thinking.
- The next generation of AI possesses:
 - ✓ short-term and long-term memory,
 - ✓ learning ability,
 - ✓ self-correction ability, and
 - ✓ reflection ability.



What to learn from school for AI and drone?

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- Sensors, IC Design
- Pattern Recognition
- Image Processing
- AI – Deep Learning Algorithms
- Connectivity and Communication – B5G
- Navigation
- Power System



Power System

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- No power, no future.
- Human labor needs rice, but AI labor needs electricity.
- TSMC Chairman C.C. Wei pointed out: the development of AI infrastructure mainly relies on three factors:
 - ✓ sufficient power,
 - ✓ sufficient semiconductors, and
 - ✓ models.



1st Topic:

AI for Passenger Escalator Safety in MRT

Pain points:

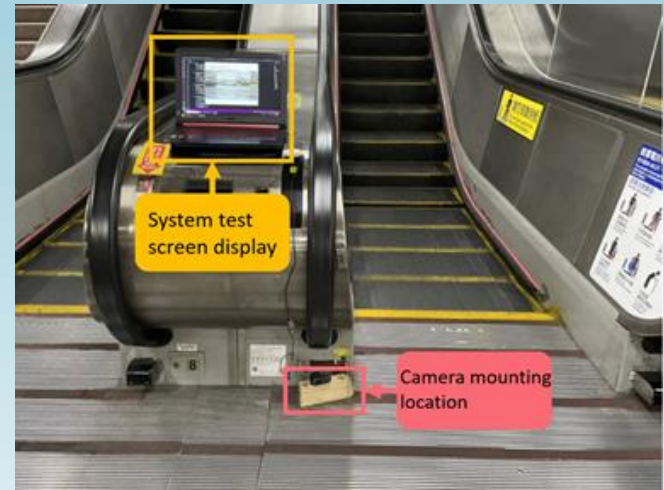
- Warning signs are difficult to notice
- Warning signs are not posted everywhere
- The warning audio is repeatedly played and is not adapted to specific situations



Passenger Escalator Safety

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Half of the injuries in MRT stations each year are related to escalators. The most common incidents are passengers' shoes or long skirts getting caught in them, and suitcases or strollers falling and causing injuries or fatalities.



Proposed Active Warning System

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- High risk items for passenger escalator



2nd Topic: AIoT in Agriculture

Pain points:

- Farming Damage and Loss
- Human-Wildlife Conflicts
- LLMs in Animal's Behavior



Animal Roadkill

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- Roadkill poses a serious threat to both wildlife and human safety, often resulting in significant ecological loss and vehicle damage. The increasing number of animal-vehicle collisions highlights the urgent need for intelligent detection and prevention systems to reduce fatalities on roads.

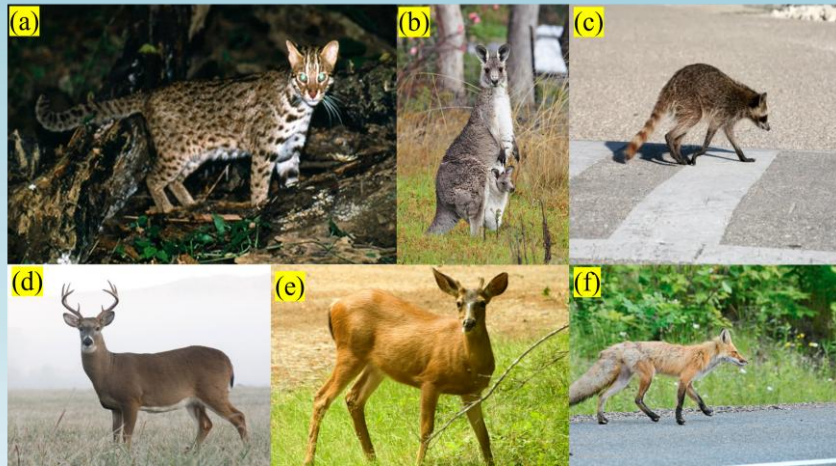


Fig. 1. Several endemic animals that are often roadkill.

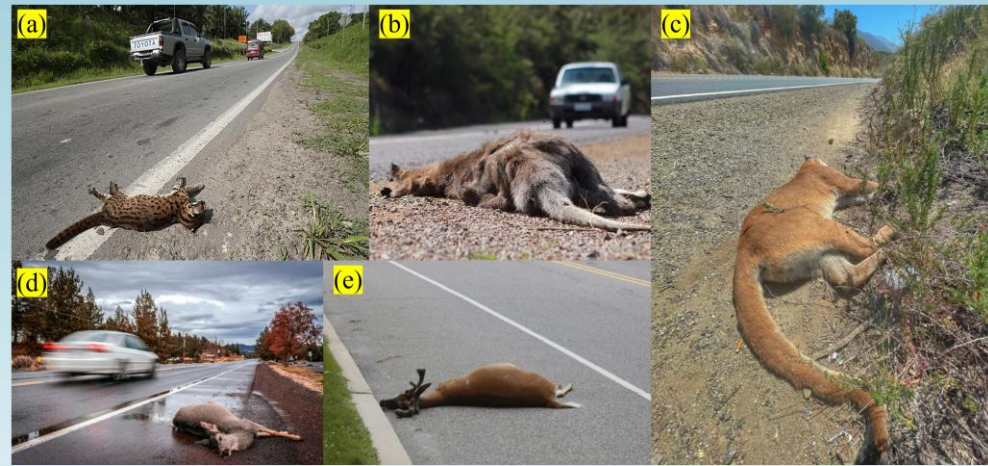


Fig. 2. Roadkill not only damages ecosystems but also harms the environment.



Formosan Macaques and Barking Deers

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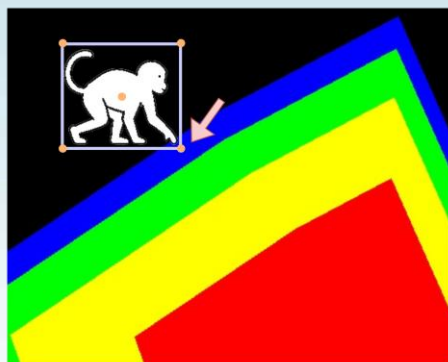
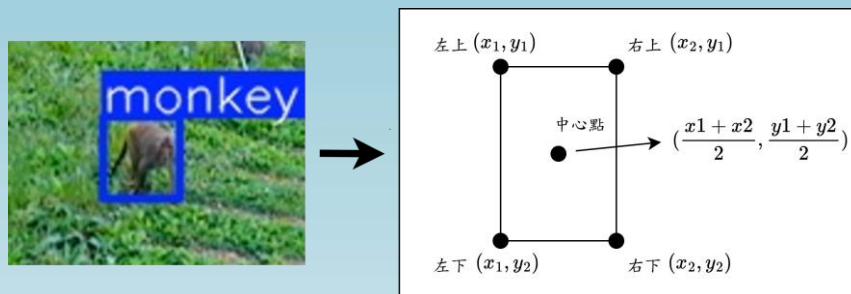
Paintball gun



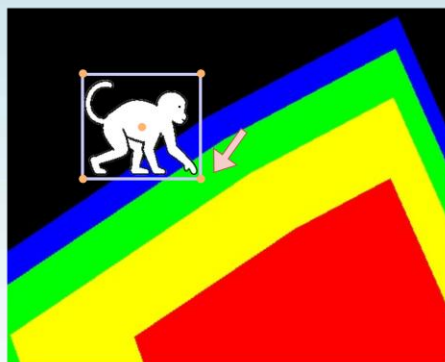
Virtual-fence Intruding Detection

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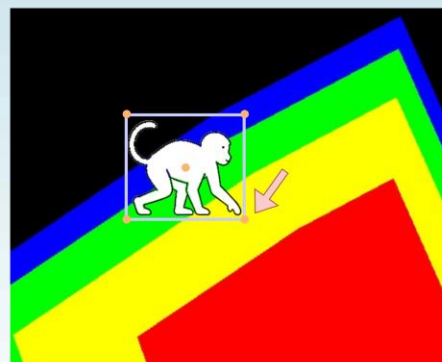
- 5 keypoints
- 4 alarm levels



(a) Level 3



(b) Level 2



(c) Level 1



(d) Highest level

AIoT System for Detering Formosan Macaques

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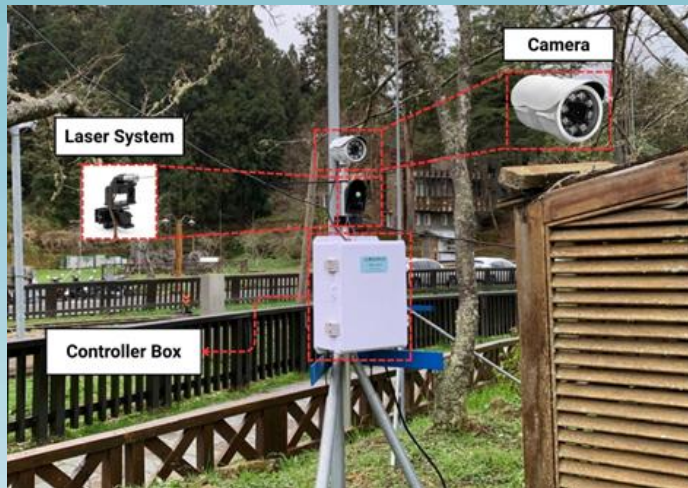


Figure 4. Overall AIoT system.



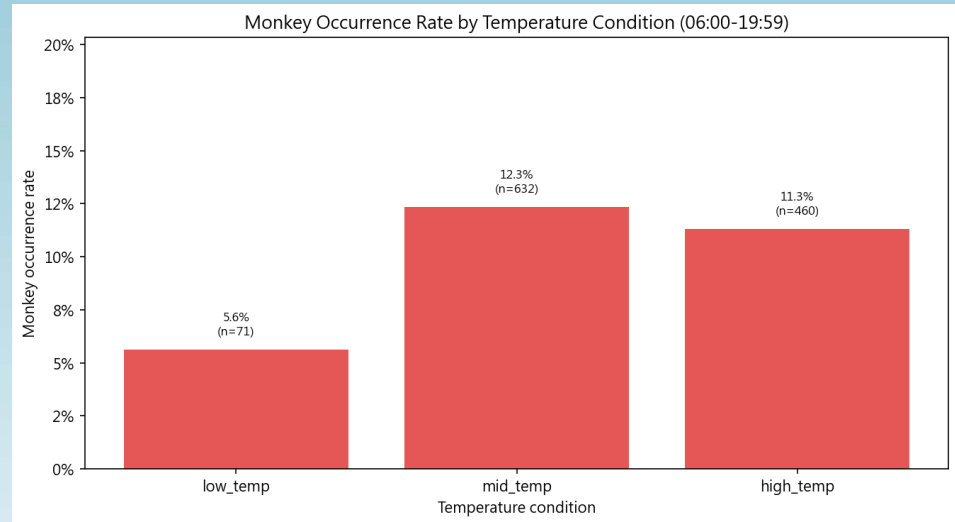
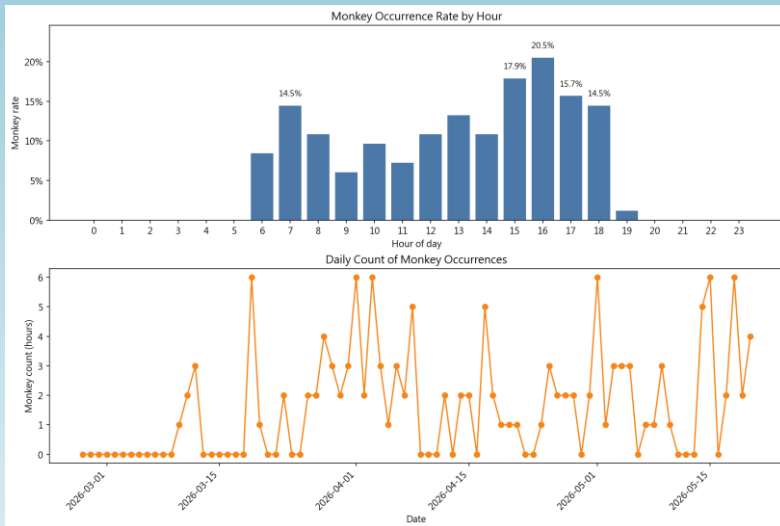
Figure 5. Detected monkeys.



LLMS vs Macaque Show Time

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- Frequency vs Time vs Weather
- In good weather conditions, monkeys showed up between 15:00~16:00pm.



3rd Topic:

AIoT in Net Cage Aquaculture

Pain points:

- Cost: Fish food + Electricity + Water → 70%
- Fish health?
- Automatic feeding?
- Precise weather forecasting? Tide and wave?
- Multi-purpose robots?



White Shrimp

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Demand	5 tons
Taiwan market	NT\$ 6.6B



Y.-P. Huang*, S.P. Khabusi, M.-C. Tsai, and F.E. Sandnes, “An adaptive learning-based model for water quality assessment in aquaculture,” *IEEE Trans. on Systems, Man and Cybernetics: Systems*, vol. 56, no. 1, pp.532-545, Jan. 2026. DOI: 10.1109/TSMC.2025.3627307

Y.-P. Huang*, S. Kshetrimayum and F.E. Sandnes, “ShrimpNet: a lightweight model for efficient detection and counting of shrimp larvae in dynamic aquaculture environments,” *IEEE Trans. on Instrumentation and Measurement*, vol. 74, pp.1-12, Apr. 2025. <https://doi.org/10.1109/TIM.2025.3563014>

Shrimp Larvae

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Vid. 1. Small numbers of shrimp larvae.



Vid. 2. Large numbers of shrimp larvae.



Challenges of the Shrimp Larvae Counting

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- Manual shrimp larvae counting (ex. 1M larvae) is prone to **human error**, making accuracy difficult to maintain.
- **Inaccurate counting** can adversely impact shrimp larvae growth, particularly when the stocking density exceeds the pond's capacity.
- The manual counting process is **time-consuming** and involves **many steps**.
- Manual handling during counting can **increase the risk of shrimp larvae mortality** due to excessive physical contact with humans.



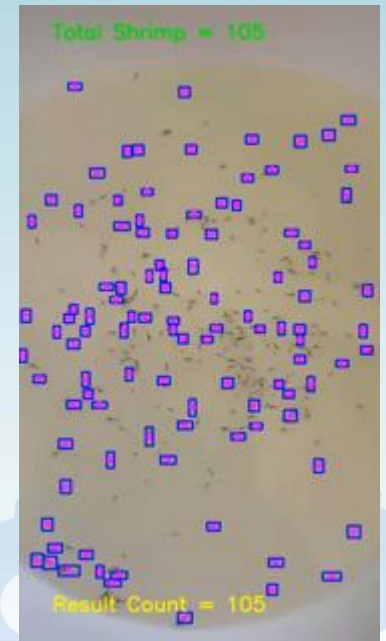
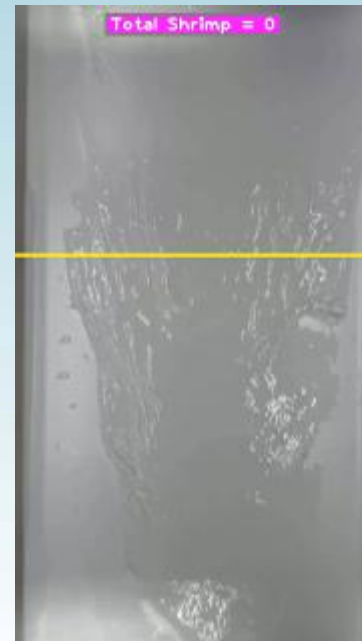
Main Contributions

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- Main contributions of this work:
 - 1) We propose **a novel method** for detecting and counting shrimp larvae called the two-stream network (TS-Net).
 - 2) We build a **comprehensive shrimp larvae dataset** containing shrimp larvae images with six different backgrounds.
 - 3) We conduct extensive **experiments to evaluate** the effectiveness of the method and compare with state-of-the-art methods.



Vid. 3. Manual counting of shrimp larvae.



Vid. 4. Automatic counting of shrimp larvae.

ROV Test

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Net Cage Anti-theft System

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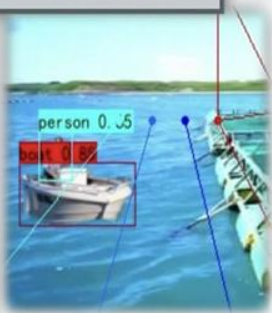
虛擬圍籬系統



人船偵測系統



警戒系統



使用者介面

智慧型海上箱網防盜系統



Future Tech Award from NSTC

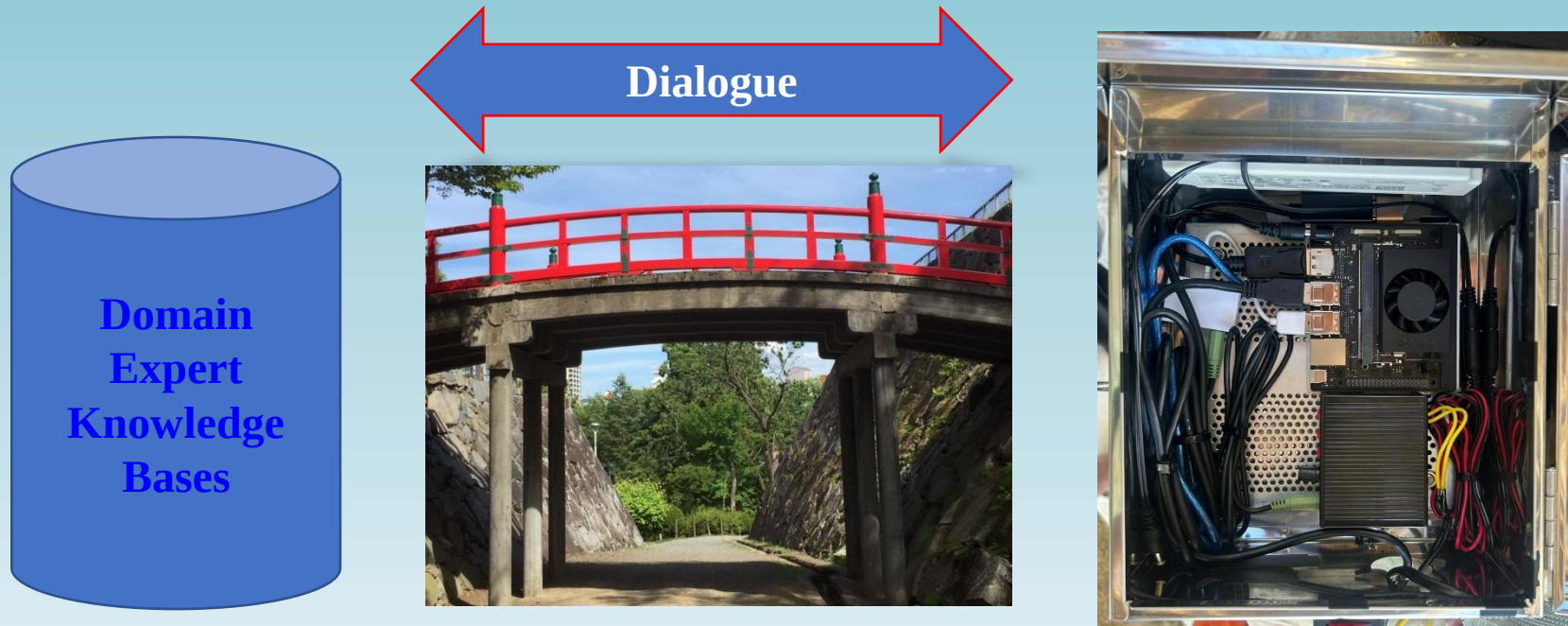
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Academia and industry: a win-win situation

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- Domain Expert Knowledge vs Engineering Skill



- Simple Yet Useful Devices, Easy to be Implemented Systems





THANK YOU

