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Aquaculture Research at NCUT: Advancing Sustainable Aquaponics Systems

National Chin-Yi University of Technology (NCUT) integrates cutting-edge research in **aquaponics**—a sustainable agricultural system that merges aquaculture and hydroponics. Through the adoption of **Internet of Things (IoT)** technologies, NCUT pioneers **automated monitoring systems** to promote sustainable food production, reduce waste, and enhance ecosystem management.

Overview of NCUT's Aquaponics Research

Aquaponics involves a **symbiotic ecosystem** where aquatic animals and plants benefit each other. In this system:

- **Aquatic animals** produce waste that breaks down into **ammonia (urea)**, which is filtered and converted into nutrients for plants.
- **Plant roots** absorb these nutrients, simultaneously purifying the water, which is circulated back to the aquatic environment.
- This closed-loop system enables **resource-efficient agriculture** by recycling nutrients and minimizing water consumption.

Innovative Features of NCUT's Aquaponics System

1. Automated Monitoring System with IoT Integration

- **IoT and Bluetooth Control:**

The system uses **Bluetooth technology** to monitor the environmental conditions, including pH, temperature, and water quality in real-time.

- **Lewei IoT Platform and SaaS Integration:**

The environmental data is transmitted to the **Lewei IoT platform** using **Software as a Service (SaaS)** technology for remote access and monitoring.

- **Automated Control Functions:**

IoT-based sensors and control systems adjust water flow, nutrient levels, and other parameters to ensure optimal growth conditions for both plants and fish.

2. Environmental Sustainability and Circular Economy

- **Efficient Waste Management:**

Fish waste is decomposed and filtered to extract ammonia, which becomes a nutrient-rich fertilizer for plants. This **recycling of nutrients** reduces waste and supports sustainable agriculture.

- **Water Conservation:**

The closed-loop system minimizes water use by continuously recycling and purifying water, achieving higher water efficiency than traditional agriculture or aquaculture alone.

- **Symbiotic Relationship between Plants and Aquatic Life:**

The plants' roots absorb nutrients and **purify the water**, creating a healthy aquatic environment for the fish, while the fish support plant growth, exemplifying the principles of **circular economy**.

3. Continuous Improvement and Research Advancement

- NCUT emphasizes **ongoing refinement** of the aquaponics system, ensuring it remains adaptable to evolving environmental conditions and agricultural demands.

- **Experiments and Innovations:**

Researchers test new plant and fish species combinations, improve filtration processes, and explore advanced IoT technologies to enhance system performance.

- **Collaboration and Knowledge Sharing:**

The university promotes **student involvement** and **interdisciplinary collaboration** to foster innovative ideas and future research developments in aquaponics.

4. Educational and Community Impact

- **Hands-on Learning:**

NCUT incorporates aquaponics research into its curriculum, providing students with practical experience in **sustainable agriculture** and **smart farming technologies**.

- **Community Engagement:**

The research also serves as a **model for local farmers** and urban growers, offering insights into sustainable food production practices using aquaponics.

Benefits of NCUT's Aquaponics Research

- **Sustainable Agriculture:**

The combination of aquaculture and hydroponics reduces environmental impact by **minimizing resource consumption** and promoting waste recycling.

- **Reduced Chemical Usage:**

Natural nutrient cycles eliminate the need for synthetic fertilizers, contributing to safer, **eco-friendly food production**.

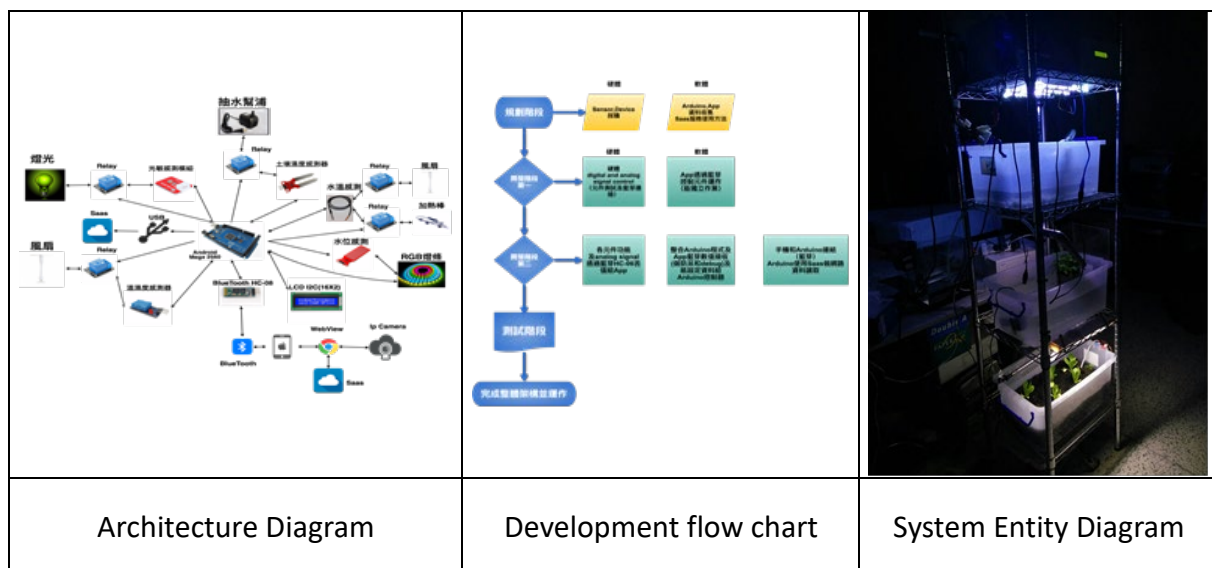
- **Resilience to Climate Change:**

Controlled environments allow the system to operate year-round, making it less vulnerable to **climate variability**.

- **Smart Farming with Data-Driven Insights:**

IoT-enabled monitoring offers precise control over agricultural conditions, improving efficiency and productivity.

NCUT's innovative **aquaponics research** highlights the university's commitment to **sustainable development**, combining **technology, agriculture, and environmental stewardship**. The aquaponics system demonstrates a forward-thinking approach to food production, waste management, and water conservation, setting an example for **smart, sustainable farming practices**.



[Aquaculture research, fish and vegetable production and research and development](#)

NCUT conducts Beach cleaning and plastic reduction activities

Environmental awareness has recently seen a surge. To advocate for earth's preservation, we must commence by clearing the surrounding litter and debris. These discarded waste items have caused environmental pollution, tarnishing the once pristine beaches. Therefore, through beach cleaning initiatives, we aim to restore the beach's former beauty.

Beyond restoring the beach's cleanliness, the student club also plays an educational role in enlightening individuals about the deteriorating relationship between humans and nature. It aims to shed light on why people generate so much waste in their daily lives and encourages reflection on personal habits that may negatively impact the environment. Beach cleanups serve as more than just a glamorous event; they offer a fulfilling, hands-on experience and serve as a profound educational opportunity. They present a new avenue for inspiring environmental consciousness and fostering a renewed life attitude.

Beach cleanup activities mark not the end of combating garbage pollution but serve as the optimal starting point for everyone to develop a connection with, cherish, and protect the ocean. See Figure 115 for further details.



Beach cleaning



Photo of Beach cleaning



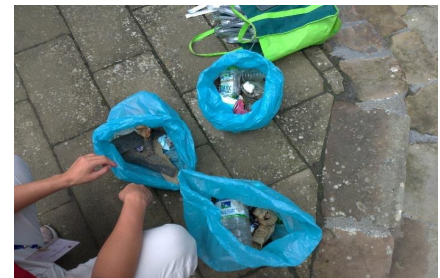
Clean up surrounding waste



Students divide the work to clean the beach



Students experience beach cleaning



Waste classification

Beach cleaning activities of student associations