aquaculture innovation centre

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AIT
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Digital Technology Driving Chinese Aquaculture

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WAS APC
AIT
Webinar

Digital Technologies for Aquaculture Production:
Useful tools for farm management

Wednesday
28 July 2021

Contents

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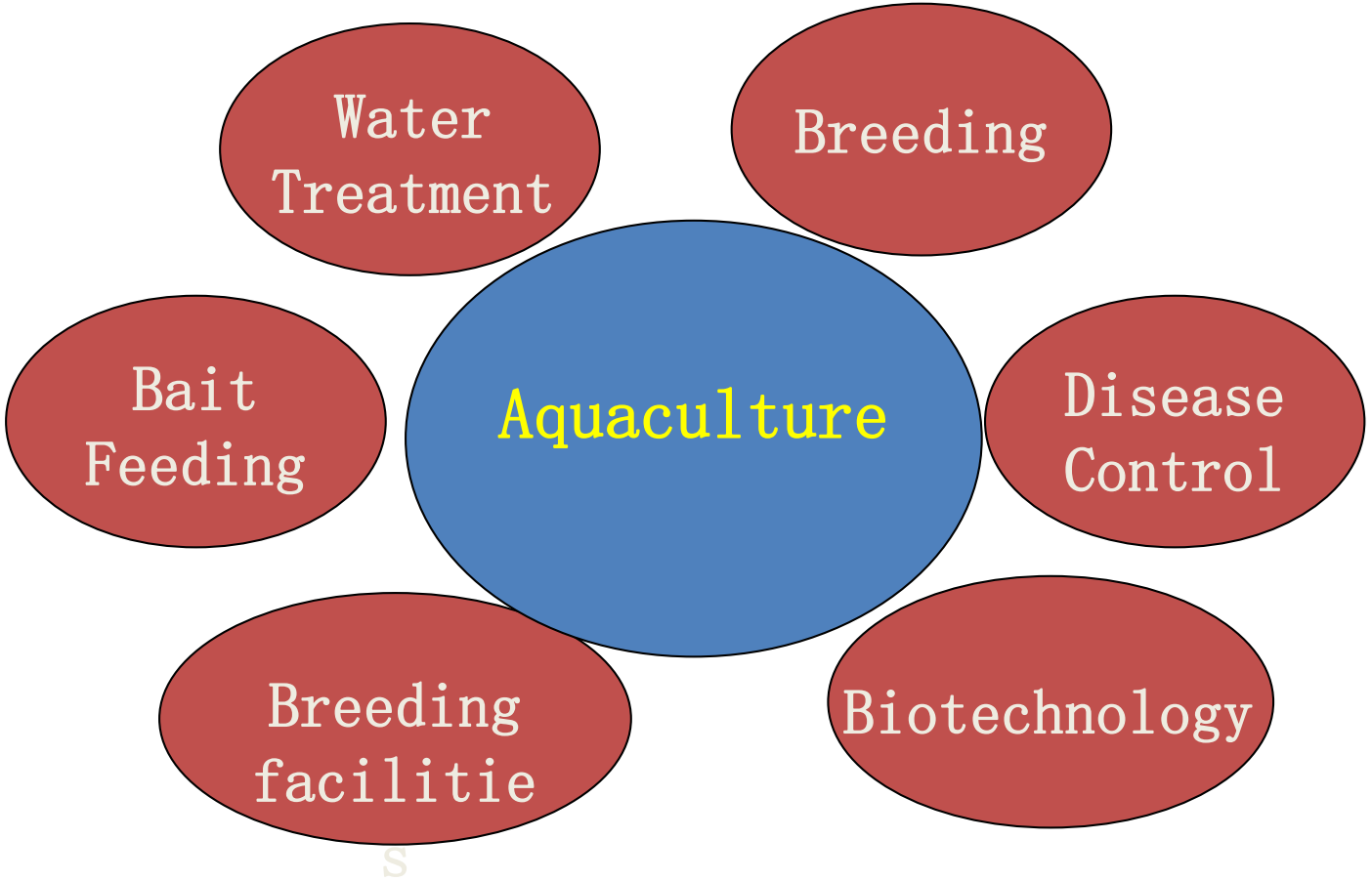
Digital Technology will Diriving Aquaculture Modernization

Digital technology affects all aspects of aquaculture



Trendency of aquaculture Mordernlization in China

The development of productive forces has brought about significant changes in the industrial structure and mode of operation of aquaculture.

- Changes in aquatic products: Become higher quality, safer and traceable.
- Mode of production: from labor-intensive to technology intensive.
- Business Model:From simple aquaculture to the integration model of "Technology, breeding, food processing, marketing and Agricultural tourism"。
- Aquatic industry transformation：Aquatic industry is experiencing a change from traditional industry mainly depends on artificial culture to Modern industry mainly bases on IT, Ecological technology,Healthy breeding technology

(1) Digital Technology accelerates the modernization of aquaculture

- in the Eleventh、the twelfth and the thirteenth five year plan,the government have supported the scientific and technological breakthrough for aquatic IT, and China has made great progress in the aquatic IOT and digital technology.
- have developed a number of advanced aquatic IOT equipment and modern fishery service information system based on aquatic IOT.
- Aquatic IOT and Digital technology has also been accepted by the aquaculture enterprises and aquaculture cooperatives.
- they considered that modern IOT and Digital technology will improve aquaculture technology level and realize aquaculture modernization。

（2） Digital Technology accelerates the modernization of aquaculture

mainly breeding mode：

1. ●Mariculture
   ●Large area field breeding
   ●Standardized pond culture
   ●industrial aquaculture。

2. **Breakthrough in key digital technologies：** **（1）Sensors and intelligent equipment technology；（2）heterogeneous aquatic IOT architecture technology （3）Model of biological growth and breeding environment regulation；（4）Refined breeding process management expert model and disease expert system**

3. In view of different cultivated species, different scales and different modes in the aquaculture process, make full use of modern sensing , wireless network, intelligent control , big data and artificial intelligence etc. digital technology, and combine the biological growth regularity model and aquaculture theories and methods to initially form intelligent, networked fine breeding process management service platform and integrated system.

二

Existing Problems for Application of Digital Technology

（1） Concerns of farmers--Digital Technology Apllication

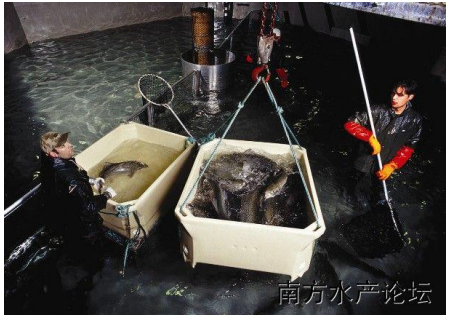
Does it can be used ?	→	stabilization and reliability
Does it work well?	→	Can the actual production problems be solved
Is it worth using?	→	Whether it can improve benefits and reduce costs

Technical issues for user

1) Sensor problems：The service life of the sensor is not long, the frequency of cleaning and maintenance is too high, and the price is higher for farmers.

2) Auatic IOT:The IOT equipments is not suitable for the higher temperature, higher humidity and higher salt environment of aquaculture.Wireless communication quality and Accuracy of control mechanism.

3)Information Service sysytem: Information system, expert system and intelligent regulation system can not meet the breeding needs of different regions



Technical issues for user

(4) lack of intelligent:Only automatic control, not intelligent control.
The regularity of core processes is not deeply understood, such as
- biological growth control
- water quality regulation,
- Feeding and biological relationship model
- Disease early warning model

Management Issues for aquaculture

1) the technical level of staffs: (A) The cultural level of employees in aquaculture industry is generally lower than that in other industries; (B) Digital technology has higher requirements for personnel.

2)Aquaculture management level:The level of aquaculture management can not keep up with the level of digital technology and aquatic IOT.

no idea of refined process,advocating manual management.

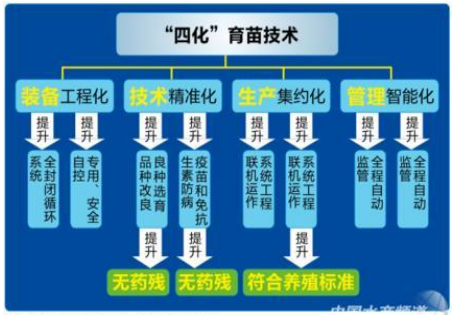


图3 苗种产业核心技术体系框架图

三

New Development of Digital Technology Application in Aquatic Industry

(1) Aquatic IOT new changes---sensors Technoloy

Different types of electrodes have been developed

- **Electrochemical sensor:** With the application of nanotechnology and ceramic technology, more durable and accurate ceramic electrochemical sensors, potential solid-state electrochemical sensors and voltammetric electrode sensors have been developed;
- **Physical sensor:** Optical sensor based on fluorescence detection technology、Optical fiber sensor based on homology and scattering technology
- **Biosensors:** electrochemical biosensor, A biosensor using chemical reaction between solidified catalyst and detection substance to sense have been developed.

Sensing components are developing towards miniaturization and higher precision

（2） Aquatic IOT new changes---sensors Technoloy

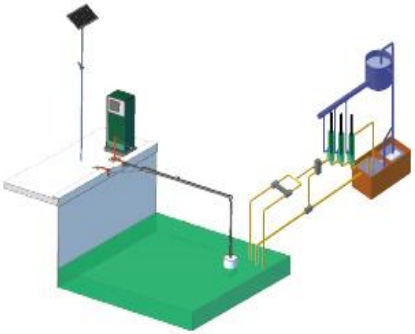
- **Multi-sensors data fusion：** established the Multi-sensors fusion model in the data layer， especially，the fusion model combined water quality with biological growth model to further reflect the relationship between water and cultured organisms；
- **Sensor array technology：** The same kind of sensors Array to improve precision，The column of sensors formed by different kinds of sensors to improve data fusion。

In order to reveal the relationship among aquaculture environmental parameters, multi-sensor data fusion technology has been further developed

（3）

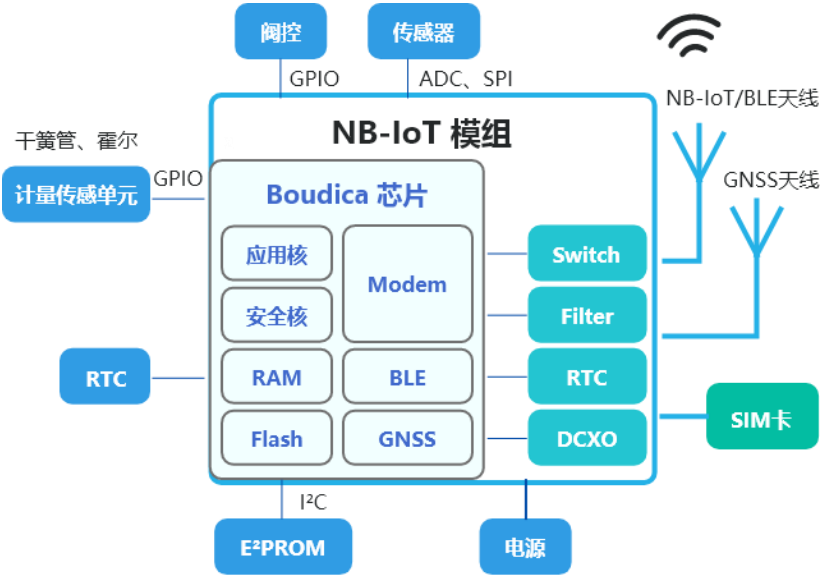
Aquatic IOT new changes---data collection and transmission equipments

- Standardization and modularization
- Plug and play
- Increased number of sensor connections
- More data transmission modes
- Easier maintenance
- Lower price



（4） Aquatic IOT new changes--- transmission

NB-IOT： Narrow Band Internet of Things



- low power consumption： 10-year lithium battery life；
- Wide coverage ability： 20 dB transmission gain， compared with GPRS， Covering 100km.
- High performance and easy deployment.
- Support NB and 5G NR coexistence deployment: Coexistence of low-speed data and high-speed data modes.

（5）

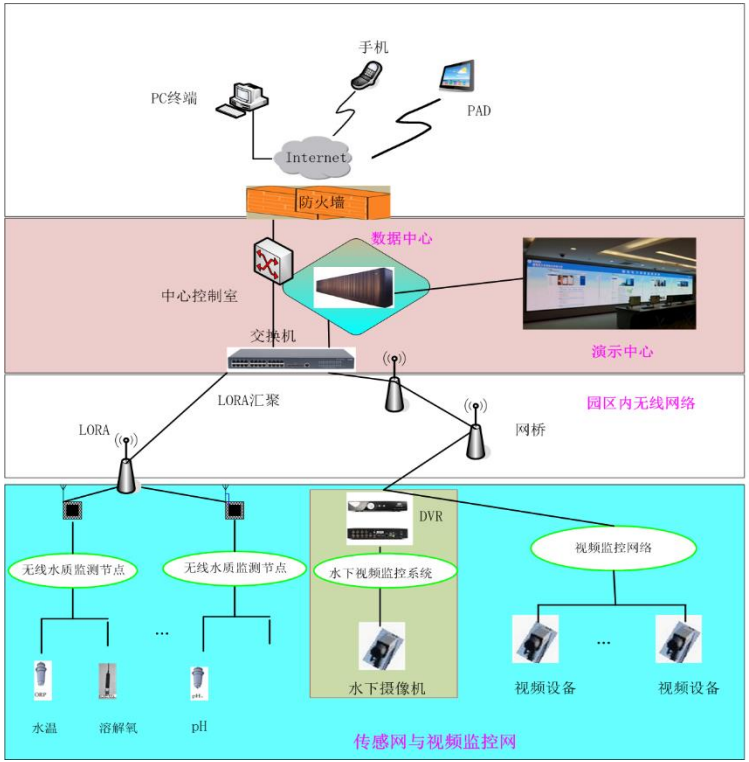
Aquatic IOT new changes--- transmission

- Low-power consumption Wan(LPWAN) ---LORA Long distance wireless technology

Lora gateway router: Stable transmission up to 21.5km

- **low power consumption： 10-year lithium battery life；**
- **Wide coverage ability： Communication Distan 5-40km.**
- **High performance and easy deployment.**
- **Support NB and 5G NR coexistence deployment: Coexistence of low-speed data and high-speed data modes.**
- **Good adaptability: cover in rural areas, Outdoor fields and ponds.**

（6） Aquatic IOT new changes--- IOT Architecture



Isomerization of access mode

- Support heterogeneous network access of NB-IOT, Lora, WIFI, RFID, GPRS and wired networks
- Mobile access of portable devices,such as PAD, mobile phone,etc.

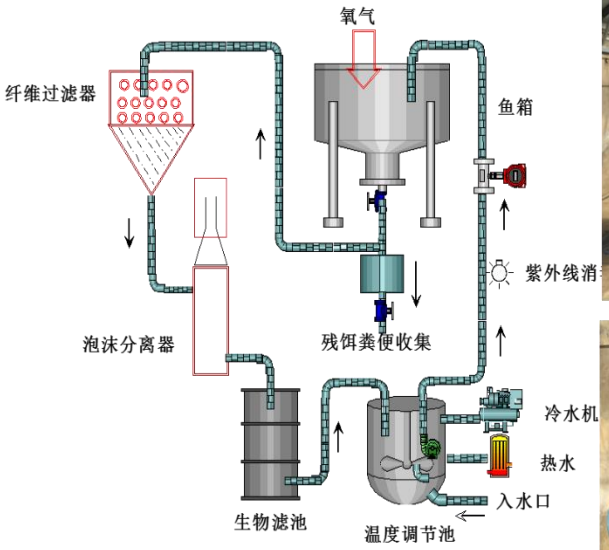
Information service platforms are cross regional

- cloud services are becoming more and more popular.
- The collaborative management of different breeding units, and intelligent equipment work together
- collaborative management of cross regional aquaculture

（7） Aquatic IOT new changes--- equipment ntelligence

- **Breeding equipment has changed from automation to networking, intelligence and systematization**

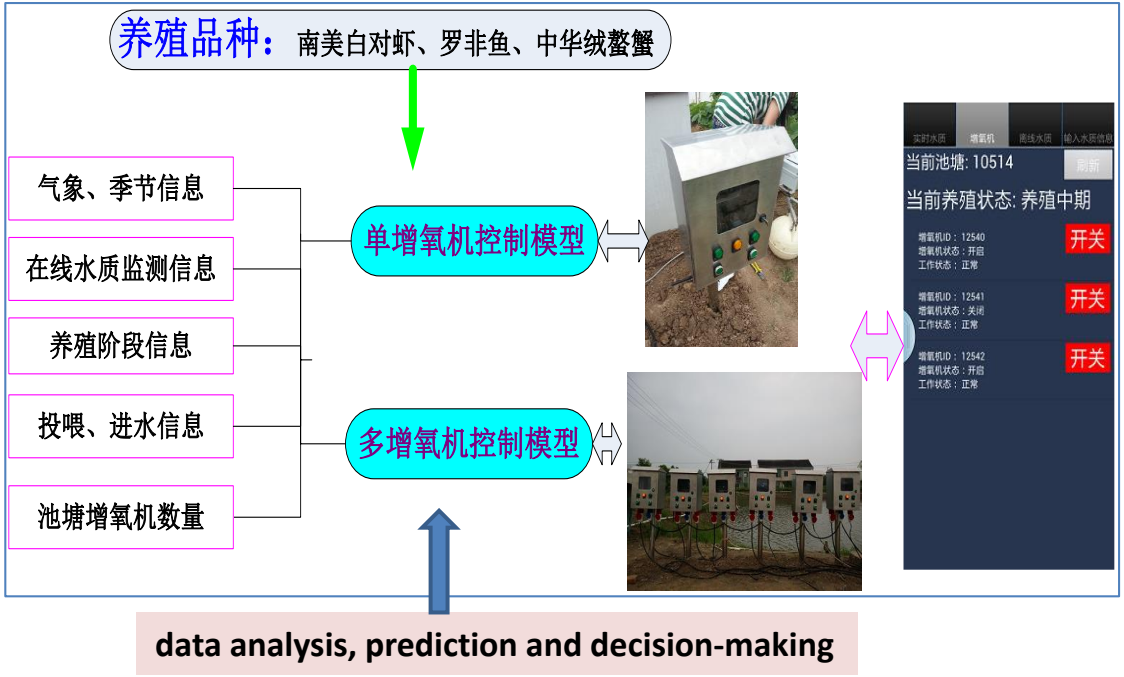
- **Expert system plays a more and more important role in intelligent control**



（8） Aquatic IOT new changes--- equipment ntelligence

- **Coordinated regulation of multiple devices**
- **Collaborative analysis of multi-source data**

Cooperative control of multiple aerators



（9）

Aquatic IOT new changes--- equipment ntelligence

Networked intelligent equipment with expert system

Networked intelligent feeder with expert system

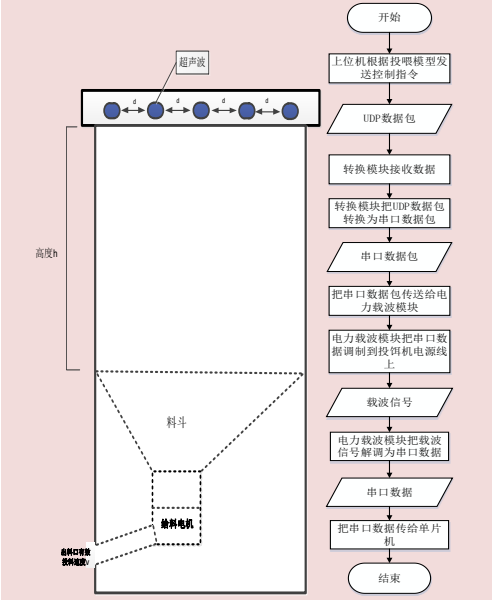
Material level control: Ultrasonic material level measuring equipment

control feeding duration:

Uniform vibration feeding motor control

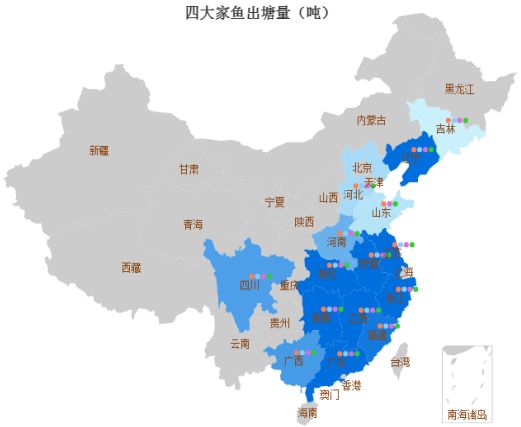
Feeder equipment regulate and control rules

Networked feeding expert system



Aquatic IOT new changes--- equipment ntelligence

- QR code and RFID are widely used;
- Breeding production mobile service terminators widely used



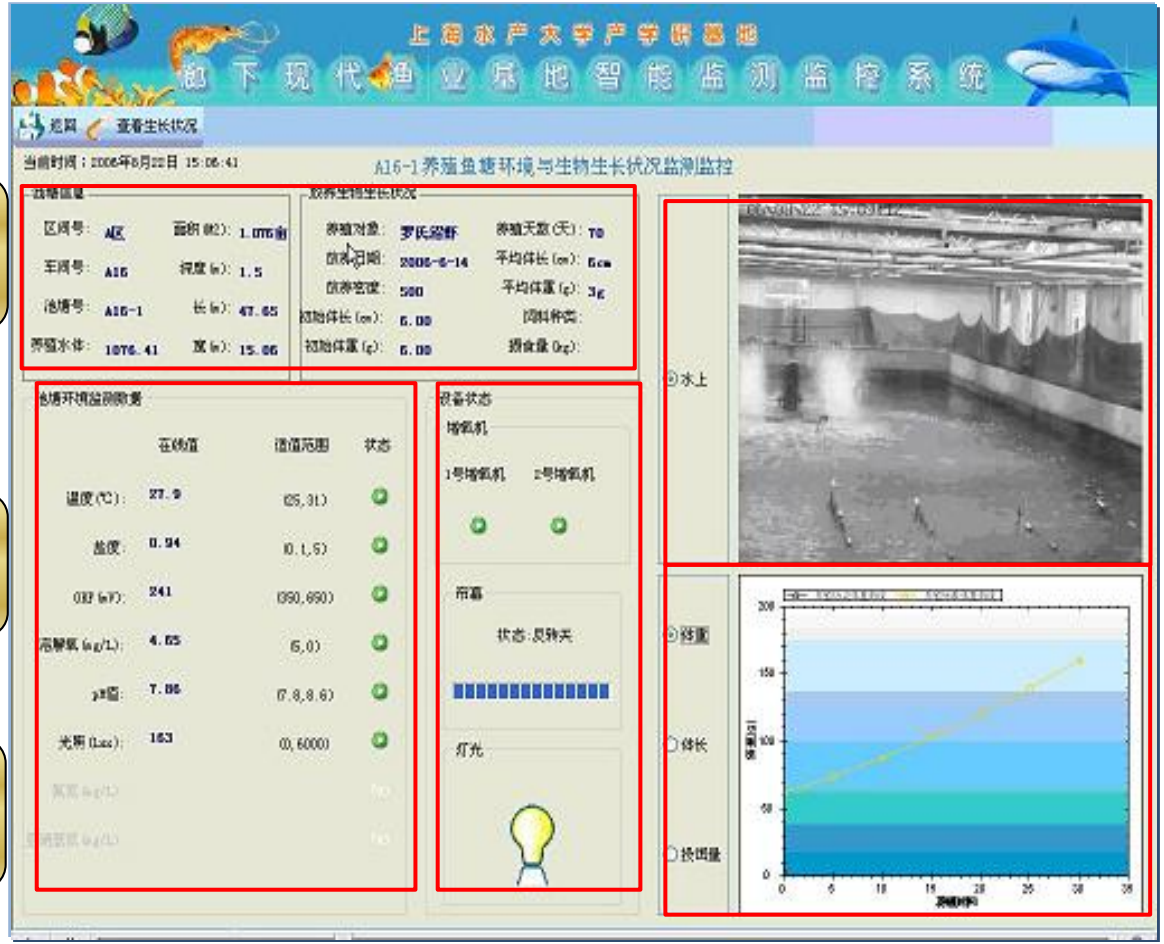
Mobile Internet equipments promote management and services

11 New change for Aquatic Info System and services

Aquaculture process management

Real time monitoring of water quality

Equipment integrated control



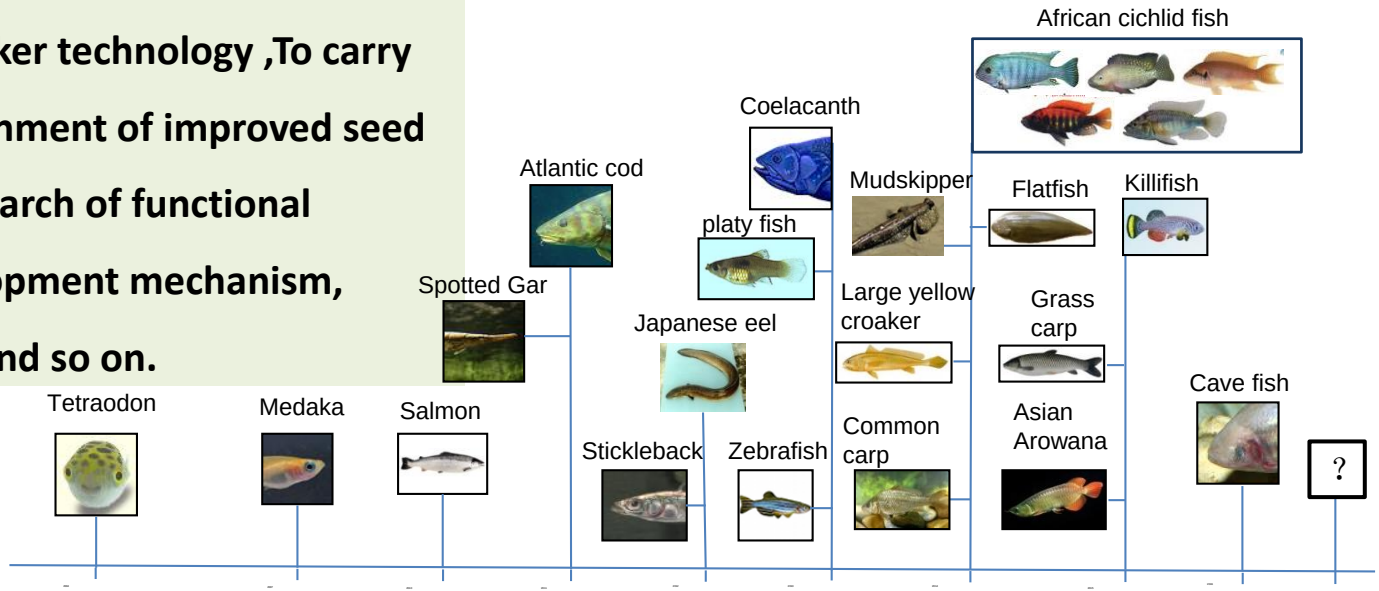
Video CCT real time linkage

Dynamic management of growth state

12 New change for Aquatic Info System and services

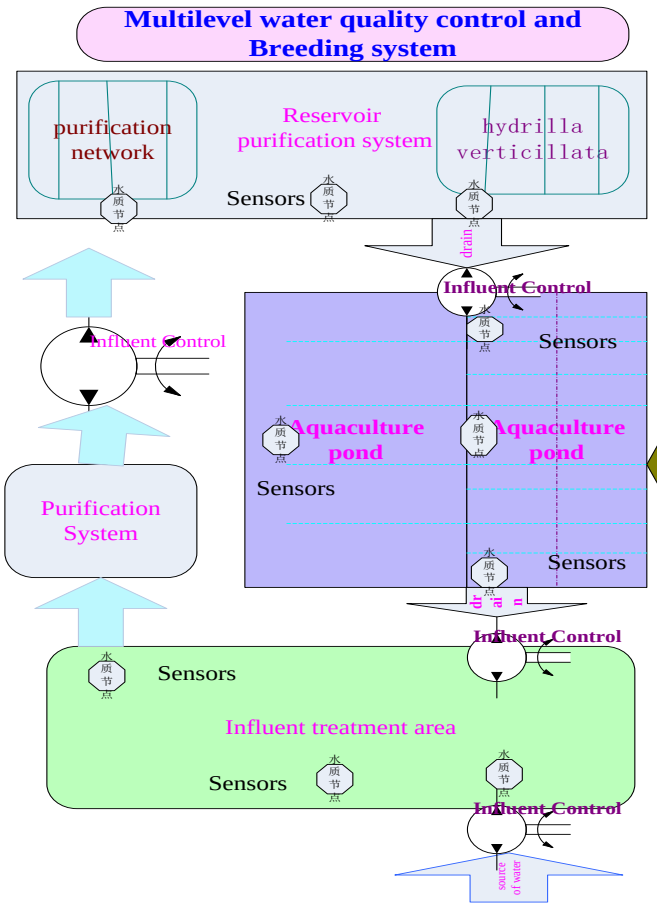
Biological information, which analysis and interpretation of structures and functions expressed in nucleic acid and protein sequences, combined with molecular genetic marker technology ,To carry out the work in the establishment of improved seed breeding database, the research of functional genome, growth and development mechanism, fishes resource gene bank and so on.

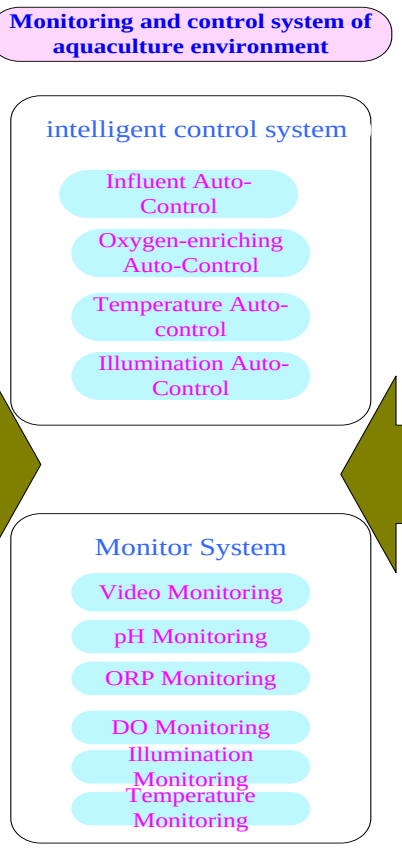
Biodiversity and fish classification

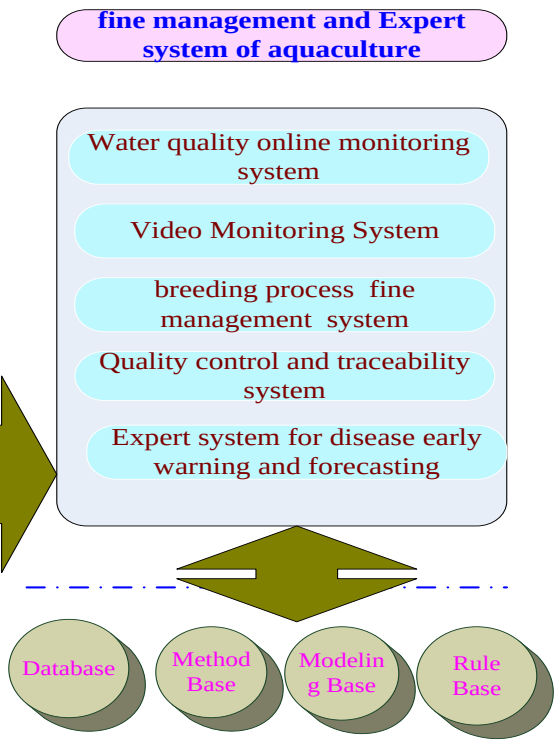


Bioinformatics is increasingly combined with genetic breeding technology

Zero emission ecological intelligent fishery integrated system







Zero emission ecological intelligent fishery integrated system

Breeding module

Three level water quality control module

Wireless control module of Internet of things

fine management and Expert system of aquaculture

thanks for listening !