# Green Ecological Crawfish Farming System Based on Digital Intelligence in IoT and AI+ Perspective

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**Abstract:** With the rapid development of the crayfish industry, the traditional farming model has been unable to meet modern production needs, facing environmental pollution, resource waste and health management and other issues. In order to promote the green and sustainable development of the industry, the Digital Intelligent Crayfish Green Ecological Farming System based on the Internet of Things (IoT) and Artificial Intelligence (AI+) technology has emerged. The system achieves precise regulation and real-time monitoring of the aquaculture environment through intelligent monitoring, data collection and analysis, effectively optimizing resource allocation and improving production efficiency. Meanwhile, the health management and early warning system combined with AI technology provides a scientific basis for aquaculture and reduces the occurrence of diseases. The application of digital intelligence technology not only enhances the economic benefits of crayfish farming, but also promotes the industry to a greener, smarter, sustainable direction.

**Keywords:** Internet of Things (IoT); artificial intelligence (AI+); crayfish farming; green ecology

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## Introduction

The crayfish industry has developed rapidly in recent years, becoming one of the important pillars of the agricultural economy. However, with the expansion of aquaculture scale and the increasing severity of environmental problems, the traditional aquaculture model is facing many challenges, such as water pollution, waste of resources and difficulties in disease prevention and control. In order to realize the sustainable development of the industry, green eco-farming model has emerged as an important way to solve these problems. With the continuous progress of the Internet of Things (IoT) and Artificial Intelligence (AI) technologies, the application of digitalization and intelligent technologies provides a new development direction for crayfish farming. These technologies not only improve farming efficiency and optimize environmental control, but also enable precise health management and early warning systems. Based on IoT and AI+ vision, the digitalized crayfish green ecological farming system will become an important driving force for future industrial transformation and upgrading.

## 1. Importance of green ecological farming of crayfish in digitalization

### 1.1. the economic significance of the crayfish industry

Crayfish industry has become one of the important aquaculture industries worldwide in recent years, especially in China [1]. As a high-protein, low-fat aquatic food, the demand for crayfish continues to grow in both domestic and international markets, driving the development of related industrial chains, including aquaculture, processing, transportation and sales. The crawfish industry not only drives the growth of the local economy, but also creates a large number of employment opportunities, especially in rural areas, and becomes one of the main ways for farmers to increase their income. With the diversification of market demand and internationalization, the export potential of crayfish is huge, further promoting the development of international trade. Promoting the sustainable development of the crayfish industry can not only increase agricultural income, but also optimize the allocation of resources, and has far-reaching significance in promoting the revitalization of the rural economy.

### 1.2. Importance of green and ecological farming

Green eco-farming is a farming mode that takes environmental protection as a premise and pursues sustainable

development, and its importance is increasingly emphasized. The traditional farming mode often aims at high yield and ignores the carrying capacity of the ecological environment, leading to problems such as water quality pollution and ecological imbalance [2]. In contrast, green eco-farming emphasizes the virtuous cycle of the ecosystem and reduces the negative impact on the environment through rational resource utilization and waste treatment. This model not only helps to protect the ecological environment of the waters, but also improves the quality and safety of aquaculture products, which is in line with the demand of modern consumers for green food. Through the introduction of natural ecological control mechanisms, green aquaculture can realize a win-win situation between economic benefits and environmental protection, promote the harmonious coexistence of agriculture and nature, and meet the national strategic requirements for the sustainable development of agriculture.

### 1.3. Contribution of digital intelligence to industrial transformation

The application of digital intelligence technology in industrial transformation is increasingly becoming a key factor in driving the development of modern agriculture. Through the integration of Internet of Things (IoT), Artificial Intelligence (AI) and Big Data technologies, the farming industry is able to achieve precise monitoring and intelligent decision-making, and improve production efficiency and resource utilization. The application of these technologies not only optimizes the farming environment and improves product quality, but also enables data-driven intelligent management, reducing labor costs and management errors. Through real-time monitoring and data analysis of the farming process, digital intelligence technology can warn of potential risks and adjust farming strategies in a timely manner, thus effectively preventing environmental pollution and resource wastage, and promoting the sustainable development of green eco-farming. The wide application of digital intelligence technology not only promotes the digital transformation of traditional industries, but also provides a new development impetus for the efficient synergy and optimization of the agricultural industry chain.

## 2.Existing Problems of Green Ecological Farming of Digital Intelligent Crayfish (Litopenaeus vannamei)

### 2.1. the limitations of the traditional mode of farming

The traditional farming model relies on empirical management and rough production methods, which have many limitations. Due to insufficient monitoring of environmental changes, the aquaculture process often fails to respond in a timely manner to changes in environmental factors such as water quality and temperature, leading to frequent problems such as water quality pollution and disease spread [3]. In addition, the traditional model is less efficient in the utilization of resources and overly relies on manual operation, which is easy to cause resource waste and cost increase. Inefficient farming and lack of accurate data support often lead to lagging and unscientific management decisions, making it difficult to achieve the goal of sustainable development. With environmental pollution, resource shortage and growing market demand for high-quality products, the traditional farming model has gradually exposed its inability to meet the development needs of modern aquaculture shortcomings. Therefore, there is an urgent need to explore a more intelligent and green farming model to cope with the existing problems.

### 2.2. Impact of environmental change on crayfish farming

Environmental changes have a significant impact on crayfish aquaculture, especially fluctuations in water quality, temperature and oxygen levels are directly related to the growth and survival of crayfish. Polluted water, abnormal pH and insufficient dissolved oxygen levels often lead to a decline in the immunity of crayfish, making them susceptible to disease and even causing mass mortality. Temperature changes also have an impact on the activity cycle and reproductive capacity of crayfish, especially in extreme weather conditions, too high or too low temperatures can trigger shrimp stress, reducing the benefits of aquaculture. With the intensification of climate change, the frequency of extreme weather events, the ecological balance of the waters are broken, which makes the crayfish aquaculture is facing greater challenges. Therefore, adapting to environmental changes and scientifically regulating the aquaculture environment have become the key to enhancing the benefits of crayfish aquaculture and sustainable development.

### 2.3. Lack of efficient health management and early warning systems

Currently, there is a general lack of efficient health management and early warning systems in crayfish aquaculture, which makes the ability to predict, monitor and respond to diseases in the aquaculture process weak. Traditional management methods mostly rely on manual inspection and empirical judgment, which often fail to detect environmental changes or early signs of disease in a timely manner [4]. The lack of systematic health monitoring tools and data support leads to a lag in the response of farmers in early disease warning and environmental risk assessment, which in turn affects the farming efficiency and crayfish survival rate. An effective health management and early warning system can detect potential problems in time through real-time monitoring of environmental parameters such as water quality, temperature, oxygen content, and the growth status of crayfish, and provide early warning and intervention, thus improving the accuracy and safety of aquaculture.

## 3.Optimization countermeasures for green eco-culture of crayfish by digital intelligence

### 3.1. Intelligent monitoring system based on IoT technology

The intelligent monitoring system based on Internet of Things (IoT) technology is able to collect and transmit various data in the aquaculture environment in real time, such as water temperature, dissolved oxygen, pH value and other key parameters, and realize remote monitoring through sensors and network devices. The system is able to reflect the changes in the aquaculture environment in real time through data collection, transmission and processing, helping the aquaculturists to grasp the trend of environmental changes at any time. Through the establishment of a big data platform, the system is also able to store and analyze the data in the breeding process for a long time and generate historical data reports to provide a scientific basis for breeding decisions. Compared with traditional manual inspection methods, the introduction of IoT technology has greatly improved the accuracy and efficiency of aquaculture management, avoiding the potential impact of environmental fluctuations on the growth and health of crayfish.

### 3.2. Application of AI+ technology in health management

The health management application of AI+ technology in crayfish farming mainly relies on methods such as machine learning, data analysis and pattern recognition to deeply mine various types of data in the breeding environment and growth process. By analyzing the relationship between changes in water quality, temperature and humidity and other parameters and the health of crayfish, AI technology can intelligently identify potential health risks and issue early warnings. For example, AI can analyze the correlation between water quality fluctuations and shrimp health to predict the occurrence of disease, thus providing accurate interventions for breeding personnel. This intelligent management not only improves farming efficiency, but also significantly reduces the risk of disease and ensures the healthy growth of crayfish. At the same time, AI + technology can also optimize the breeding strategy to achieve accurate feeding and resource management, and promote the sustainable development of crayfish farming.

### 3.3. Optimization and implementation of green ecological farming models

The optimization and implementation of the green ecological aquaculture model focuses on reducing the negative impact on the environment while ensuring the production of crayfish. Through rational water quality management, ecological recycling systems and sustainable resource utilization, the green aquaculture model can minimize the use of chemicals in the aquaculture process, avoid water pollution and promote the ecological balance of the aquaculture system. For example, biofilter technology is used to purify water quality, and natural resources such as water plants and plankton are utilized to regulate water quality and reduce the concentration of harmful substances such as ammonia and nitrogen. Through the introduction of intelligent monitoring systems, real-time monitoring of water quality, temperature and humidity, and other environmental factors, to ensure the stability and health of the aquaculture environment, thereby improving the survival rate and yield of crayfish. In addition, optimizing farming space and stocking density helps reduce resource waste and promote the long-term sustainable development of green eco-farming.

## 4.Conclusions

Based on IoT and AI+ technologies, the Digital Intelligence Crayfish Green Ecological Farming System can effectively improve the automation and intelligence of the farming process, optimize environmental management and health monitoring. Through accurate real-time data collection and analysis, the system not only improves breeding efficiency, but also realizes environmental monitoring and early prevention of disease warning. The application of these technologies not only promotes the green transformation of the industry, but also provides an innovative path for the traditional farming model, which helps to cope with the environmental changes and health management challenges faced in the current farming process. In the future, with the further maturation and promotion of the technology, digital intelligent farming mode will improve productivity while promoting sustainable development, laying a solid foundation for the long-term development of the crayfish industry.

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