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Perspective

Aquaculture Farm Management Using Surrogate Models Utilizing the Internet of Things and AI

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DESCRIPTION

Taiwan and the rest of the world are facing labour shortages in agriculture due to low labour participation among young adults and an ageing agricultural population, which will impact aquaculture production. The proposed system is primarily intended to solve the problems encountered by Taiwan's aquaculture farming sector by designing a smart Internet of Things (IoT) fish monitoring and control system outfitted with various IoT devices to enable real-time data collection; thus, fishpond water-quality conditions and other system parameters can be easily monitored, adjusted, and assessed remotely. This analysis also develops a Deep Learning Model (DL) that correlates the different parameters of the smart aquaculture system in order to predict the growth of the California Bass fish. To find the best DL model configuration for producing accurate predictions on the given experimental data set, Bayesian optimization-based hyper-parameter tuning was used. The DL model can be integrated into the self-feeding system, reducing the amount of leftover feed. Thus, aquaculture based on Artificial Intelligence of Things (AIOT) can help fish farmers intelligently control and manage various fishpond equipment remotely, as well as help aquaculture operators perform professional aquaculture, lowering the industry's entry barrier and promoting aquaculture.

Over the last few years, the Internet of Things (IoT) and other advancements have contributed to the innovation of traditional agricultural practices. Because workers are required to supervise the farms, the labour required by traditional fish farming techniques raises the cost of production. Aquaculture production will be hampered by a labour shortage as the average age of agricultural workers rises in various parts of the world. Major changes are required to resolve this issue; automated operations should be managed remotely. Labour costs can be reduced and productivity can be increased with the Internet of Things. In the future, the technology will have a significant impact on monitoring and analytics. Organizations can integrate a plethora of IoT devices to collect massive amounts of data that can be stored and analyzed.

IoT technological advancements can help it realize its full potential; intelligent devices and analytics frameworks are being produced all over the world on a daily basis. Modern aquaculture practices have resulted in overproduction, resulting in recurring outbreaks of fish illness and poorer seafood quality. To eliminate the risk of asphyxia caused by low oxygen levels, contaminated water, parasites, or disease transmission, a solution is required. The sensor's data can be used to identify and solve problems in the fish farming industry, such as improving fish health. As a consequence, the benefits of integrating IoT in the industry are enormous. It facilitates effective monitoring by providing a broad coverage of data from multiple locations, allowing for real-time remedial actions to be implemented. Cloud platforms used with IoT must have data redundancy and scalability. Artificial Intelligence (AI) and Machine Learning (ML) technologies can use data collected over time to create massive predictive models that can be used for correct decision-making, process automation, and timely warnings. Aquaculture is incorporating more and more artificial intelligence into smart aquaculture systems using AIoT.

AIoT-based aquaculture systems can monitor water quality, microclimate, and provide warning functions all at the same time, improving early warnings and response times, and their equipment can be linked with an intelligent electric box to control water wheels, pumps, feed machines, and other equipment. Furthermore, the data collected by an AIoT system can help to improve the accuracy and intelligence of aquaculture through the use of sensors and feed data. This will result in labour savings, stable water quality, energy savings, and accurate feeding. It can make aquaculture more productive and beneficial by reducing disaster and damage risks. Furthermore, the degree of fish feeding technique has a strong influence on overall productivity and nutrition costs. Significant economic benefits can be realized by optimizing the feeding mechanism. Furthermore, as the demand for high-quality aquatic products grows, there is a greater emphasis on fish health throughout aquaculture. Unconsumed feed, in addition to consuming oxygen, contributes to the production of ammonia and other

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poisonous compounds, affecting the fish's health and development. When determining the creature's actual feeding requirement, a few key factors must be considered. With automation machines, this can be extremely difficult. To address this issue, a smart monitoring system for fish farming with artificial intelligence frameworks capable of forecasting and determining animal feeding tactics is required.