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Seafood Aquaculture Management Platform Based on LoRa Mesh Self-organized Network

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Abstract: This paper is based on the seafood aquaculture management platform in the mode of "platform+base+farmer" to achieve commercialised and technological seafood aquaculture management. Through the intelligent machine operation on the Internet, the data collected by various sensors are aggregated on the cloud platform through LoRa Mesh self-organising network and NB-IoT 5G transmission, and the light, temperature, PH value, salinity, dissolved oxygen and so on in the seafood farm are monitored online in real time. Once the "evil conditions" unfavourable to the growth of seafood appear, through the cloud platform analysis and processing, it will immediately provide real-time feedback of early warning information and solutions to the farmers through WeChat, SMS and other means, so that the farmers can find problems in time to solve them. Remote control can also be achieved through the timing and quantity of intelligent feeding, and then the scientific breeding of seafood, effectively increase the yield of seafood, improve the quality of seafood, thereby improving the economic income of farmers.

Keywords: Smart agriculture; Seafood farming; LoRa Mesh; Cloud platforms

1. Preamble

The continuous expansion of the aquaculture industry has pushed forward the economic development of China, and the continuous economic development in improving people's living standards at the same time has indirectly led to the destruction of the marine ecology and the decline of resources and the frequent occurrence of fishery diseases, the pollution of the water quality and the people's overfishing has led to the emergence of the quality and safety of seafood incidents, which seriously affects the large number of exports of seafood.

Based on this industry dilemma, we designed a seafood aquaculture management platform based on LoRa Mesh self-assembling network, through the study of various types of growth data in the process of seafood aquaculture, all-round management and monitoring of aquaculture temperature, water quality, seafood growth conditions, etc., and the establishment of a seafood aquaculture real-time monitoring and management of the cloud platform, to ensure that seafood in the seedling, aquaculture, feeding, etc., the farmers can receive real-time data analysis from the platform in a timely manner by mobile phone WeChat, SMS and other ways to receive real-time data analysis issued by the platform in a timely manner, and make a solution to the early warning information, can to a certain extent to ensure the quality and safety of seafood, and then can increase the yield of seafood, is to achieve the scientific aquaculture of seafood is an effective means of raising the economic income of farmers need.

2. Related technologies

2.1 Mesh self-organisation

Mesh is wireless network mesh, is a multi-hop mesh, from ad-hoc network development, Mesh networking is a multiple Mesh mesh networking. As the sea area for seafood cultivation is vast, mesh networking effectively increases the signal coverage and solves the problem of the "last kilometre" of communication, and the communication distance can be increased to 20km.The hardware of LoRa Mesh self-assembling network adopts the RF-AL42UH module of Shincida, and connects the nodes with sensors of temperature, light and dissolved oxygen, and the information collected by the sensors is automatically transmitted to the nodes, and

the nodes and the nodes are connected to the nodes with the information collected by the sensors. The information collected by the sensors is automatically transmitted to the nodes, and the nodes transmit the data to the Internet stably and quickly after a successful handshake with the server. This project also makes use of the MMBCR algorithm of the mesh routing protocol, which automatically selects the node with relatively large remaining power to do the routing, and avoids the problem of nodes "striking" at the same time.

2.2 AliCloud Platform

After the launch of Ali cloud, has gradually commercialised AI technology, which is built up with AI vision technology as the core of the "city brain", is an important scene of the cloud computing cloud platform. Cloud computing is a sufficiently low-cost, commercialised model to solve the problem of large-scale computing. In order to facilitate real-time early warning for water quality monitoring and water pollution in the seafood aquaculture area, this automatic aquaculture management system adopts a real-time water quality monitoring and alarm system based on a cloud platform, which includes four parts: the data acquisition module, the Arduino main control board, the AliCloud IoT platform, and the application terminal. In this system, the information collected by the sensors will be uploaded to the AliCloud IoT platform through the Arduino main control board, and accessing the cloud platform with a web browser will enable real-time querying of the water quality of the monitored seafood aquaculture area and save this data, so that the owner can query the data to analyse the work through the historical records.

3. System Design

The seafood aquaculture management platform is mainly divided into three layers. In the hardware layer, the Arduino Mega 2560 is used as the main control board, and the data collected by various sensors (dissolved oxygen sensor, salinity sensor, PH sensor, waterproof temperature sensor, light intensity sensor) are obtained through the serial port, and the lithium batteries and solar panels are used to provide a more reliable power supply to the main control board, and the lithium batteries will be replenished with power when there is the sun, and can provide power to the main control board through the stored power of the lithium batteries when there is no sun. When there is sun, the lithium battery will be replenished with power, and when there is no sun, the power stored in the lithium battery can be used to provide power to the main control board. In order to obtain the location of each main control board, each main control board has a GPS positioning module, which is used to determine the location of the main control board, and to prevent it from being lost by the seaside; in the network layer, in order to be suitable for outdoor environments and the collection of data from multiple regions, a LoRa is used on each main control board to carry out the transmission of data in each region, and the data between LoRa is transmitted through the LoRa. The information is transmitted between LoRa through LoRa Mesh self-assembling network to increase the efficiency and stability of information transmission, and the information from LoRa is summarised to the master LoRa, and then NB-IoT is used to connect to the AliCloud platform through the MQTT protocol, and the master control board and the AliCloud platform are able to exchange data through the json format after they subscribe to each other; in the application layer, the data stored on the AliCloud data can have a variety of applications, now mainly through the Web page and WeChat applet call AliCloud's API to get data, and finally through the visualisation of the page to the user to see the data collected back by the main control board in each area of the seashore, and the other way is to send a message to give the user a more real-time alerts? and can also be controlled through the Web side of our feeding system.

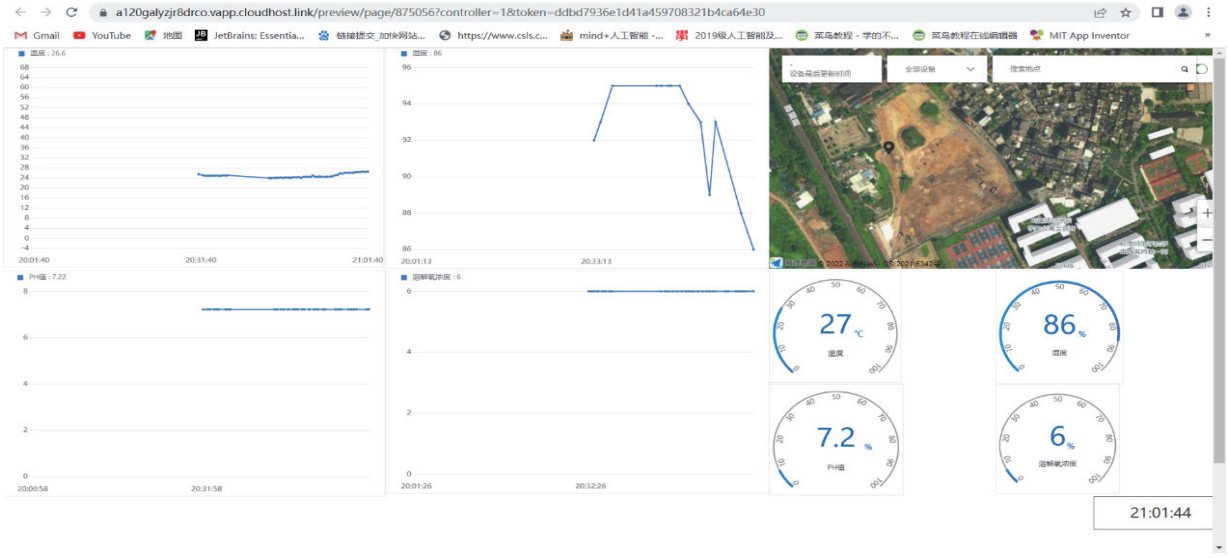

Figure 1 AliCloud Web visualisation page

4. System implementation

The AliCloud Web visualisation page is shown in Figure 1, where four line graphs present the status of the data records, which can be very intuitive to show the status of water quality at a certain period of time. From the temperature value of the sample water quality can be seen that the current temperature of the sample water quality has been showing a stable state, the surface of the current no bad weather. The humidity value of the sample water changes can be seen in the current environment, humidity presents irregular state, this time the user needs to take protective measures. PH value of the sample water quality can be seen in the water quality of the acid and alkali presents a stable state and presents a neutral, indicating that the water quality is very good. Dissolved oxygen concentration of the sample water quality also tends to be a very stable state. The four line graphs in the figure show that the data transmission process is very continuous and smooth. In addition, the platform has a real-time positioning function, you can view the current location of each device in real time, you can search for each device to view and intuitively present a 3D version of the map, more clear at a glance. The platform also has a real-time data monitoring function, you can real-time monitor the current water quality temperature service, air humidity, water quality PH value and dissolved oxygen concentration. The visualisation of the data can show the real-time changes in the data and whether the output is stable or not.

Data collection and analysis system as shown in Figure 2, the left data collection and analysis system can be viewed in real time every current monitoring, so as to grasp the first-hand situation of each place; the middle area is to show every water collection specimens and the corresponding information address (coordinates), you can query the water quality of this area through the address of the information and can add and delete the collection specimens at any time the information; The right side of the display is to query the current water quality of the three time periods of the morning, midday and evening data, and as long as a piece of data exceeds the safety value of the range will issue a warning, prompting the user to take major measures.

Figure 2 Data acquisition and analysis system

5. Conclusion

LoRa Mesh self-organising network technology is used to achieve that the equipment collects aquaculture information such as water temperature and water quality and transmits it to AliCloud. Through the AliCloud to receive and analyse the data to establish the optimal growth model of seafood aquaculture, and then through the WeChat app and Web page to the farm real-time environmental data feedback to the farmers. With the characteristics of temporary networking, rapid deployment, no control centre, and strong resistance to destruction, it can directly face the harsh environment of the sea. The solution of "evil conditions" can be selected by the farmers by viewing the early warning information issued by the WeChat applet, and then remotely operated on the mobile phone; it can also achieve automatic precision feeding by analysing the growth information of the seafood, solving the problem of declining production caused by the fuzzy control of the feeding amount of seafood, thus greatly and effectively circumventing the economic losses and protecting the farmers' property safety.

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