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Research Article

Design of an Autonomous Aerator System for Aquaculture Applications

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Abstract

Technological advancements in Aquaculture system controls important variables and aids an improving production. This paper presents a robot which has sense to understand sediment oxygen demand. It aerates by considering sediment oxygen Demand (SOD) of the waterbody. The aeration is a wave generation microbubble aeration that aerates by a mechanism at the sediment-water interface (SWI). This helps to reconstruct the oxidized layer. One module can aerate up to 1 hectare of the Aqua-pond. It transfers rate of oxygen to water from air is twice of blower and micro bubble tubes. Automation for mechanical setup through electronic box (microcontroller, sensors, communication components, etc...) by using this device we controlling and monitoring the aerator 24/7 scenario. Once the parameters (DO, PH value, ammonia, etc..) got reduce in waterbody immediately our sensor will act and switch-on the equipment, again the water parameters got standardized it will switch-off automatically. Even it will run without any observation by fixing time on the daily regular basics.

***Keywords*—**Aerator, aquaculture, automation, microprocessor

I. INTRODUCTION

Day today life aquaculture farming aerator is design as Paddle Wheel type like structure shown in fig (1.2). Through this paddle wheel device is converting rotary motion of a shaft and linear motion of a fluid. In the linear-to-rotary direction,

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it is placed in a fluid stream to convert the linear motion of the fluid into rotation of the wheel.

So this rotation can be used as a source of power (or) as an indication of the speed of flow. In the rotary-to-linear direction, it is driven by a prime mover such as an electric motor or steam engine and used to pump a fluid or propel a vehicle such as a paddle-wheel steamer (or Steamship).

Tomoaki Itano designed a water streamer for the purpose of enhancing cost-efficient circulate flow between the water surface and bottom in shrimp aquaculture Ponds. We took direct measurements of the water current field induced by the designed aerator in a large rectangular reservoir of dimensions (L)50_(W)19_(D)1:3 m3 and compared the results with those of a standard Taiwanese paddle-wheel aerator. Vertical circulation between the surface and the bottom induced by the paddle wheel aerator was smaller than the designed aerator. Furthermore, the paddle-wheel aerator consumed more electric power than the designed aerator. The structures of water current induced by the two aerators are elucidated, and the advantages and disadvantages of the aerators are discussed. Overall, the designed aerator was found to be more efficient than the standard aerator.

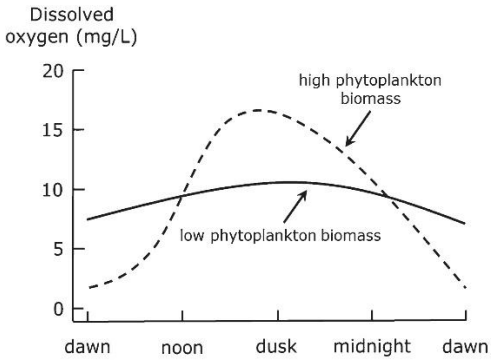


Fig: 1.2.1 Readings in Graph

Sibo Liu Energy efficient aeration device for aquaculture, in line with "by more than a generation, dynamic aeration" train of thought for technical design and improvement. Removable aeration terminal as the core, multi-level water to improve the method, the mobile fading pore aeration, intelligent mobile and open and close as the main function, aimed at solving the existing pond aeration efficiency, low energy consumption is high, the function of a single problem. From energy saving, efficiency, biological bacteria on the three directions, the aquaculture industry of energy conservation and emissions reduction. Device of the main advantages are: 1, original mobile fading aerator on the one hand, to expand the scope of work, playing a micro porous aeration of dissolved oxygen with high efficiency and to achieve "by more than a generation", on the other hand, through the sports equipment, stir the mixture of water, the water surface of photosynthesis of plants rich in dissolved oxygen input parts of the tank, compared to the stillness of the aerator can be more fully dissolved oxygen. 2, through the opening of the pressure sensor indirect control device, can make the equipment timely and stop operation, convenient an use at the same time avoid the waste of energy.3, the biofilm suspension an aeration terminal, can be accomplished by nitration of microbial multi-level water improvement, still can make biofilm increase rate of netting in the movement process, the biological and mechanical aerobic promote each other, improve the efficiency of both. In addition, the device has small power consumption, low cost of characteristics. And have a certain degree of technical barriers, have their own

intellectual property rights and high degree of product market demand, easily accepted by customers, has a very high popularization value.

Mohammad Tanveer Surface aeration systems viz., paddle wheel and spiral aerators are the most commonly used aeration systems an intensive aquaculture practices. Use of aerators an intensive aquaculture is important for ensuring better survival, optimal oxygen supply, higher production, and disease free environment. Hence, selection of properly designed and high efficient aerators is necessary to maintain adequate and continuous supply of dissolve oxygen (DO) in semi-intensive and intensive aquaculture and keep the energy consumption (operating cost) to minimum. Paddle wheel and spiral aeration systems have advantage of cost effectiveness, low maintenance and easy availability. In the present study a review on previous studies related to standard aeration efficiency (SAE) and standard oxygen transfer rate (SOTR) of paddle wheel and spiral aeration systems has been discussed.

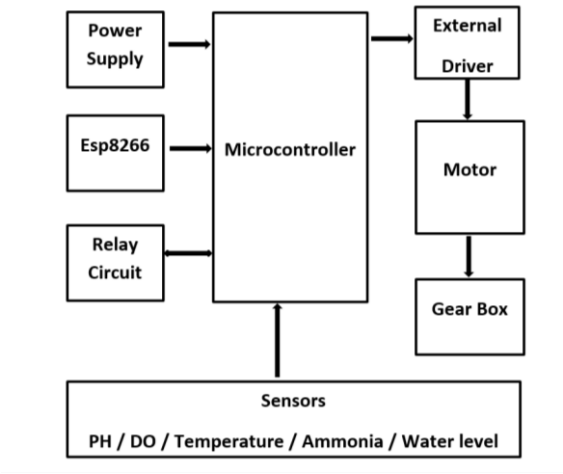
Rajeeb K. Mohanty The effect of paddle wheel aeration on shrimp growth and survival were studied at a commercial farm at Chandipur coast of Orissa, India, at different stocking densities, four different aeration patterns were adopted and evaluated. Influence of individual aeration pattern on average survival rate was not highly significant ($p<0.05$) at different stocking densities, while different aeration patterns had significant influence ($p<O.OOl$) on survival rate of P. monodon. It was also estimated that 1.77 hp(aerator) is needed for every 1000 kg shrimp biomass which corresponds to 1hp/565 kg biomass of shrimp. Higher growth rate was mostly observed during 63-98 days of culture, when six 2hp aerators were in use. Size variation in growth was higher during initial stage of rearing, while it was reduced to significant level towards the last phase of rearing as number of aerator and hour of operation increased.

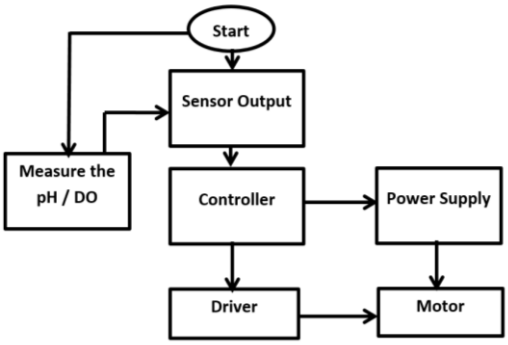
NHUT TIEN NGUYEN The energy consumption for aquaculture in Vietnam, especially shrimp farming industry, has continued rising considerably in recent years due to the expand of shrimp production to meet food demand. Most of energy demand at shrimp farms is consumed by aeration system which uses electric motors to drive aerators for improving dissolved oxygen in ponds. In addition, the intensive energy consumption from electric motors for aeration and pumping systems leads to high operation cost and associated greenhouse gas emissions. Although many improvements have been done for the design and operation of aerators and even renewable energy resources have been applied, mechanical aerators still consume high power with low oxygen transfer from air. Therefore, this paper proposes an optimal design for advanced aeration system in which the electrolyze powered by renewable energy might produce onsite pure oxygen according to the changes of dissolved oxygen level in shrimp ponds. The optimal results obtained from the elitist genetic optimization algorithm with life cycle cost and CO2 emission as objective functions conducted in off-grid and on-grid modes are compared with mechanical aeration system powered by national grid. The comparison in terms of life cycle cost and CO2 emission results that the hybrid system supplied by wind and photovoltaic power with national grid as backup represents the best conjuration for the investigated shrimp farm because it not only provides better competitiveness for life cycle cost and low gas emission but also procures revenue at the end of the project lifetime.

II. METHODOLOGY

Usually to develop the System it requires in two scenarios like Hardware and Software specification then it could be the complete description of the behaviour about the project. This includes specification of functional and non-functional requirements of the application. The

interaction of the users with the application is represented with the help of use cases and their analysis.





Initially it will start from sensor value like, first it will measure the sensor which we connected and depends upon the value it will operates, if value is more than the limit just replay to sensor like sense after few hours. If the value is less than the limit then, it will send the signal to the controller to switch on the aerator like, it could be the motor in the diagram.

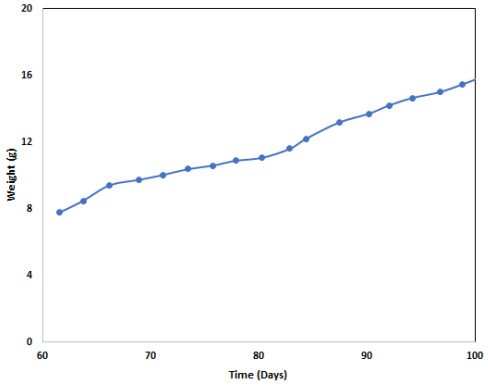


Fig: 1.3.1 Sensor of Aerator

III. RESULTS AND DISCUSSION

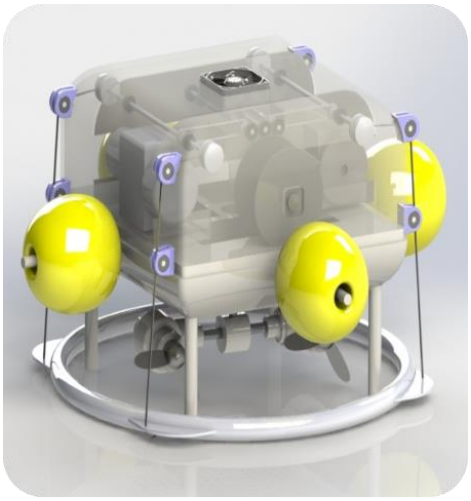


Fig: 1.3 Micro-Bubble Aerator

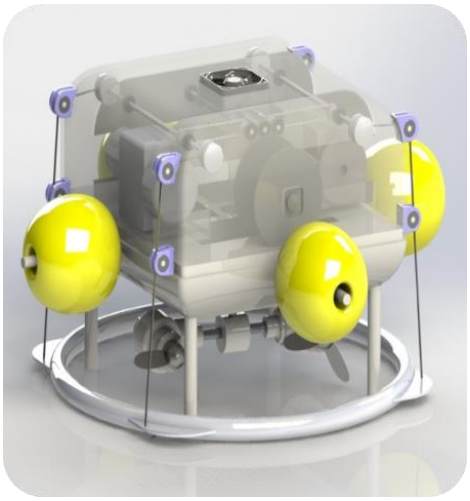


Fig: 1.3.1 Sensor of Aerator

The way this system works will help former to get monitored and helps to drain excess water from fields. GSM module helps us to get connectivity to the Cloud server even crop field far from cities or villages. Raspberry PI is nothing but a ARM processer minicomputer that enhances with many applications.

Aerator is a robot kind of thing which has sense to understand sediment oxygen demand. It aerates by considering sediment oxygen Demand (SOD) of the waterbody. The aeration is a wave generation microbubble aeration that aerates by a mechanism at the sediment-water interface

(SWI). This helps to reconstruct the oxidized layer. One module can aerate up to 1 hectare of the Aqua-pond. Lotus is 50% more energy efficient than Paddle wheel, propeller aspirator. It transfer rate of oxygen to water from air is twice of blower and micro bubble tubes.

IV. CONCLUSION

Cloud is the software and database that run on cloud servers all over the world. By using cloud computing users and companies don't have to manage physical servers by themselves. Initially system read values from all sensors and updates in Cloud. then we measure values of temperature sensor and moisture sensor to confirm whether it is raining or not , if it is raining then we will check the water level of the crop field through a water level sensor, the water level reaches beyond low water level in rain condition we command our system to open the drain valve to drain the excess rainwater and to protect the crop, and we do not forget the smart irrigation system , not raining then we will measure soil moisture level if the moisture level less than threshold value we want to swath on the motor but here we are introduced weather prediction technic to save energy and to protect crop at the same time, when soil moisture level enters below the threshold value the system take predations from the cloud then it will process and conform that chances rain or not, if not then the motor will on and irrigate the crop filed equal to the threshold value of soil moisture, if there may be chances of rain then system will check another condition that is the storm or not, if not in the safety point of you irrigate the crop with 25%< to threshold value of soil moisture because in weather prediction chances of rain. then the system will measure temperature and humidity then it will confirm the chances of rain is High or low, if low then the system will irrigate crop 25%< threshold value of soil moisture. There may be chances of heavy rain then the system will irrigate 50 %< threshold value of soil moisture. The logics of the algorithm help to identify whether there is need of water

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