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Comparative study of routing protocol used for monitoring water quality

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ABSTRACT

Aquaculture is a rapidly-growing industry in the world. Aquaculture used to reproduces raise and gathering of see food and plant in wide range of water like lakes, waterways, river and sea. So it is necessary to have good quality of water and right degree of water, temperature and PH value for grow up healthy sea food.Water quality of a fish pond depends on the pH level, dissolved oxygen, and temperature and few other criteria. In fish farming, monitoring of environmental parameters helps to manage the quality of water in the pond in order to avoid the probability of critical conditions which can harm the organisms. Many routing protocols have been proposed in order to provide an efficient route discovery between the sources and the sink. In this paper, we present a review and comparison of different algorithms, proposed recently in order to fulfil this requirement. The main purpose of this study is to address the issues like data forwarding, deployment and localization. The proposed system is energy efficient and reliable.

Keywords:*Wireless Sensor Networks (WSN), IOT, Fish Firming, Routing Protocols.*

1. INTRODUCTION

Fish farming is mainly based on the characteristics of the water in the aquaculture pond. In order to increase fish yields, the parameters such as temperature, pH level, salinity, dissolved oxygen and nutrient levels are to be kept at most favorable levels in water. These parameters can change a lot during the period of a day and can quickly vary depending on the external environmental conditions. Though, a limited water quality monitoring applications based on wireless sensor network are used in industry. The quality of water of a fish pond is generally monitored by testing done in laboratories. This process is time consuming as the owner of the fish pond needs to send sample to the lab and get results after testing. The different applications based on water quality monitoring have been recently developed.

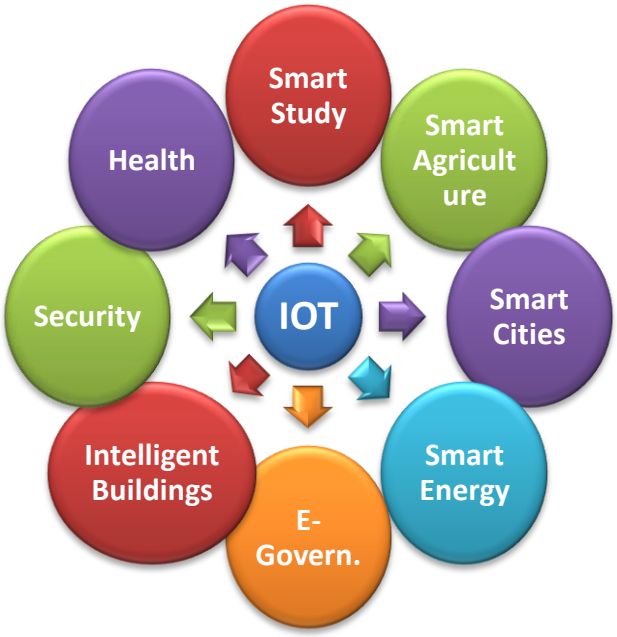
2. WIRELESS SENSOR NETWORK

Wireless sensor network is important part of communications. Wireless sensor network having different applications like, agriculture field, home security, industry, health care, manufacturing and so on. WSN have some challenge like

energy efficiency, fault tolerance, scalability, security. Most studied challenge by researchers is energy efficiency in wireless sensor network. To improve the energy in wireless sensor network different protocols and algorithm are designed and developed. A wireless Sensor Network is collection of different sensors nodes. Sensor nodes are used to monitor surrounding data and obtained process data. And forward this data towards a base station located on the sensor network. Sink node in WSN collect the data from the sensor nodes and transmit this data to some remote control station[8][9].

3. INTERNET OF THINGS

Internet of Things (IoT) is also most rapidly growing technique. Internet of Things (IoT) is a network in which all physical objects are connected to the internet through the network devices. IoT allows objects to be controlled remotely across exiting infrastructure. Different applications of IoT are fish farming, medicine, power, gene therapies, agriculture, smart cities, and smart homes just a very few of the categorical examples where IoT is strongly established. Figure.1 shows different applications of IoT.



"Fig1: Applications of Internet of Things"

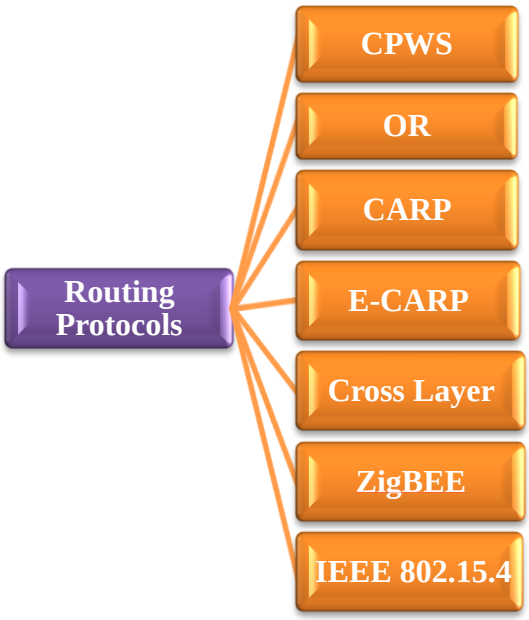
3.1 IOT in Fish Firming

Aquaculture is a rapid-growing industry due to significant increase in demand for fish and seafood throughout the world. Aquaculture refers to the breeding, rearing, and harvesting of plants and animals in all types of water environments including ponds, rivers, lakes, and the ocean. But some parameters are important for fish firming, like low dissolved oxygen in water, temperature, salinity and pH level of the water. These parameters can change a lot during the period of the day and can quickly vary depending on the external environment. The pond production is confined by the provision of dissolved oxygen. Dissolved oxygen is the most discriminating satisfactory parameter, on the grounds that shrimps in the low dissolved oxygen are greater prone to sicknesses.

Temperature:The temperature is also important parameter, to understand the nature of fish. If temperature of water goes high out of level then fish cannot survived.

pH Value:pH value is used for to know the acidic characteristic of water which is also important for fish firming. The acceptable range of pH in fish blood is 6.5 to 9.0. Fishes are not comfortable with the water that has below or upper pH ranges 4.0 to 5.0 or 9.0-11.0 respectively.

Oxygen**:**Oxygen level is also very important in fish pond for fish survival. Dissolve Oxygen is measure by parts per million (ppm) in the water, and generally water contains 3-10 ppm of Oxygen. To grow healthy fishes, fish farmer knows about the oxygen level of water. Cold water fishes survive at 7ppm dissolve oxygen and warm water fishes need 5ppm dissolve oxygen. The quality of water of a fish pond is generally monitored by testing done in laboratories. This process is time consuming as the owner of fish pond need to send the sample in the lab and get the results after testing. So deploying IOT based sensor application for monitoring water quality in fish pond will definitely help in such situations and also will give before timely alerts regarding the contaminants in the water to the fish farmers using a user friendly interface. So proper action can be taken according to need of requirement in fish pond and get better water quality for fish cultivate. Different energy efficient protocols are designed and developed for aquaculture. Following figure shows different types of protocols has been used for IoT based fish firming as follows:



"Fig2: Types of protocols used for IoT based Fish firming"

3.1.1 CPWS:

For fish pond monitoring system effective and energy efficient RGB sensor based Clustering Protocol of Water Sensor network (CPWS) is used. It is used for monitor water level and water quality. CPWS protocol has longer lifetime. Author also facing some challenges like, all sensors are floating on water surface and also work on rainy environment [1].

3.1.2 OR:

Opportunistic routing (OR) is based on Under water Wireless sensor network (UWSN). OR protocol is a group of nodes used for select the next hop forwarder. It is used to deliver the packet to the destination. Transmission reliability and throughput increased using OR protocol [2].

3.1.3 *CARP:*

The Channel-Aware Routing Protocol working on PING PONG strategy. A sensor node replies a PONG control packet and receiving a PING control packet to simplifying evaluation and selection of a relay node by the source node. It is quickly varying conditions of the underwater channel. So it may not be sufficient to give the guarantee that longer data packets are also going to be safely delivered [3].

3.1.4 E-CARP:

Enhanced version of Channel-Aware Routing Protocol. It is worked on location free and greedy hop-by-hop packet forwarding strategy. CARP tries to avoid the forwarding of control packets when selecting relay nodes, and to reduce the routing of sensory data packets to the sink node. This is the energy efficient protocol [3].

3.1.5 NCRP:

Novel Cross-layer Routing Protocol based on network coding for Under Water Wireless Sensor Network. It is worked on network coding and cross-layer design greedily forward data packets to sink nodes efficiently [4].

3.1.6 ZigBee module with IEEE 802.15.4:

IEEE 802.15.4, and implements the routing protocol based on the ZigBee standard. [5,6]

3.1.7 Dynamic Clustering technique:

The proposed system is energy efficient and reliable. As the sensor nodes have constraint of energy, computation etc. The dynamic clustering technique will make use of three parameters such as residual energy, density and distance from BS and accordingly CH will be selected. Hence the sensor which are active will send the values to CH. Due to this, the lifetime of the network will increase and the system will be beneficial as it will provide real time values to the fish farmers .So that they can take necessary step to improve the water quality to increase production of yields[7].

"Table1: Comparison of various routing protocols"

Sr. No.	Protocol	Advantages	Disadvantages
1	Clustering Protocol of Water Sensor network	Effective and energy efficient	facing some challenges like, all sensors are floating on water surface and also work on rainy environment.
2	Opportunistic routing	Reliable and increase the network throughput.	Time consuming.
3	Channel-Aware Routing Protocol	Underwater channel conditions quickly varying.	It may not be sufficient to give the guarantee that longer data packets are also going to be safely delivered.
4	Enhanced version of	CARP tries to avoid the	This technique is not used to

	Channel-Aware Routing Protocol	forwarding of control packets when selecting relay nodes, and to reduce the routing of sensory data packets to the sink node.	differentiate the priority of different attributes.
5	Novel Cross-layer Routing Protocol	NCRP utilizes network coding and cross-layer design to greedily forward data packets to sink nodes efficiently.	Less performance.
6	ZigBee module with IEEE 802.15.4	The flexibility of the network, low cost, low energy consumption	Low data transfer rate
7	Dynamic Clustering	To design and implement an routing algorithm using the concept of dynamic clustering to increase the lifetime of the sensor network.To reduce the energy consumption of sensor network in the proposed network	Time consuming.

4. CONCLUSION

Different routing protocols are used for monitoring water quality of fish firming. Proposed dynamic clustering technique is better for IoT based monitoring water quality for fish firming. The routing algorithm using the concept of dynamic clustering will increase the lifetime of the sensor network. To reduce the energy consumption of sensor network in the proposed network.

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