Fish robot to monitor oceanic flora and fauna

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Abstract - **In this research the fish robot is used for monitoring the flora and fauna of the marine life. There are various types of plants and animals present in the sea. There are a lot of uses of these plants and animals to human being. Human being cannot reach at each and every point of sea. Submarine can go inside the sea but it has also certain limitation of time for which it can travel. In this paper it is proposed to send a fish robot inside the sea which can travel round the clock inside the sea. Its task will be to monitor the flora and fauna of the marine life. It can even monitor the quality of water. Quality of sea water may be hampered due to oil spilling from cargo ship. It will be detected by the fish robot to save the sea life. Even the robot fish can be used to show path to large vessels. It can also avoid the collision between two ships. Even it can detect large icebergs in advance and large vessels can be turned away from the icebergs in advance.**

keywords - **fish robot, ocean, sensors**

1. Introduction

The research is related to [1] s as fish [87] robot is used to monitor ocean life. Further the research is related to ocean as the fish [88] robot [2] is utilized to monitor the aquatic life in the sea. The research is related to fish [89] robots [3] as the fish [90] robot [4] is used to monitor the marine life. Further the research is related to flora and fauna of ocean as fish [90] robot [5] can be used to monitor them. Further the research is related to underwater robot [6] as fish [91] robot is one kind of water robot.[7] Further the research is related to pollution of water as the fish [92] robot [8] can be used to monitor the pollution of sea water. Further the research is related to navigation of large vessels. Further the research is related to tornado and cyclone as it can monitor them. Further the research is related to monitor the presence of ice bergs to prevent them from colliding them with large vessel. Further the research is related to global warming as it can monitor the melting of ice and rise in the water level. Further the research is related to swimmers and divers the robot [9] show them the path. Further the research is related to entertainment as the robot [10] can be kept in aquarium. Further the research is related to oceanic research as the robot [11] can be used to carry out research related under water ocean. Further the research is related to offshore wind turbines as the fish [93] robots [12] can be used to monitor the underwater tower condition. Further the research is related to submarines as it can guide the submarines. Further the research is related to fish [94] science as it can be used for studying growth and evolution of fishes.[95] Further the research is related to the study of underwater sensors as the various sensors are used in the construction of robots. [13] Further the research is related to the study of underwater vision camera as they form very important part in construction of fish [96] robots. [14]

Michihiko Furuhashi developed a dog robot. [15] This dog can hear. This robot [16] is useful to those for helping people who are hearing impaired. This robot [17] is useful to deaf people for picking up a phone call. This robot [18] is equipped with a touch-based communication system. When the phone rings, the dog robot [19] hears the sound. Then the dog robot [20] physically touches the body of a human being to inform about the phone call. The dog robot [21] physically touches the body of the human being to inform about the phone call. This robot [22] gives information about the phone call to the required person only. This robot [23] is designed such that while touching the human being, it should not harm people. In these robots, [24] artificial skin is used. In these robots, [25] due consideration is given for the safety of the human being. This robot [26] can be controlled using a laptop. This robot [27] is a mobile robot [28] and can move to find the required person. This robot [29] is also equipped with the vision camera to find the particular person. This robot [30] is also equipped with the distance sensors to measure the distance between the robot [31] and the particular person. This robot [32] is also equipped with internet facility and can also check for incoming emails. This robot [33] is also fitted with the obstacle avoidance system. He carried experiment on the robot [34] with around 15 people sitting in the room. The robot [35] is trained to give the message of phone call to a particular person in a room. He also conducted an experiment on the dog robot's [36] performance when there is a loud music in the room. Speed of this dog robot [37] is around 36 cm/sec. The robot [38] is trained with two types of contacts. The first type of contact is with regular interval. The second type of contact is with irregular interval.

Win-Bo-Di developed a robot [39] for welding purposes. He used arc-welding machines for his experimentation. He used structured light vision in his robot. [40] Weld-seam is detected using structured light vision in his robotic welding system. Precision welding can be done with his system. Cost of welding is also reduced. Real-time monitoring of welding quality is possible in his robotic system. He used optical triangulation method for finding the location of the seam. For measurement purpose, calibration is necessary. He developed a calibration methodology of vision camera. He developed a calibration

methodology for extrinsic parameter and intrinsic parameter of vision camera. He also developed calibration steps for laser plane. He used a charged coupled device camera in his welding robotic [41] system. He also used laser technology in his robotic [42] system. In the same way, he used a calibration chess board in his system. The accuracy of welding is increased in his system. The structured light vision system consists of two basic structures. The first structure is called as a stereo-structural light. The second structure is called as monocular structured light. Light strip images are used in stereo structured light vision system. The images are captured with minimum two cameras simultaneously. With the help of stereo vision system, 3D co-ordinates of a particular point are computed. But in this system, time is required for computation of co-ordinates. This method is very complex, and the cost of measuring system is also high. So, the second method called monocular structured vision is a favorable choice. It overcomes the drawbacks in the earlier method. In this method, one camera is sufficient. Structured laser system is also used in this method. The strength of the welded joint depends on the precision of the welding system. Some scientists used calibration block for calibration purpose of the vision system. But the accuracy of this method was up to 0.45mm. Some other scientists used light scanners in the robotic [43] system. He provided a mathematical model for the calibration system. He developed a pin hole model for vision camera.

2. Objective Fish Robot

1. The objective is to develop a fish [97] robot [44] for monitoring marine life.
2. Further goal to monitor the flora and fauna of the ocean using fish [98] robot. [45]
3. One more target is to provide navigation facility to large vessel using fish [99] robot. [46]
4. Yet another goal is to monitor the pollution of the water using fish [100] robot. [47]
5. Similarly the aim is to monitor the tornado and storm in the sea by using fish [101] robot. [48]
6. Likewise the plan is to monitor the ice melting in the sea using fish [101] robot. [49]
7. Correspondingly the fire goal is to locate the presence of icebergs in the sea water to provide protection to large vessel from collision.
8. Furthermore, the goal is to provide the facility for oceanic research using fish [102] robot. [50]
9. One more goal is to provide entertainment facility to people by keeping fish [103] robot [51] in the aquarium.
10. One more goal is to provide facilities to the ocean swimmers to show the path while swimming using fish [104] robots. [52]
11. Further aim is to provide facilities to carry out research on fishes [104] by monitoring the growth of fishes. [105]
12. One more aim to provide the facilities to submarines to for guiding the path to move.
13. Yet another goal is to monitor the underwater tower of offshore wind turbines.
14. Further aim is to build a fish [106] robot [53] to monitor aquatic flora and fauna without disturbing the fishes [107] as the fish [108] robot [54] looks like a fish. [109]
15. Further goal is to develop an underwater robot [55] in the form of the fish [110] robot. [56]

3. Need of monitoring sea

1. Oil spilling in seawater from cargo ships.
2. Security purposes.
3. Monitoring welfare flora and fauna of the sea.
4. For monitoring the impact of offshore wind turbine in marine life.
5. To monitor hazardous poisonous waste in the sea.
6. For navigation purpose of large ships.
7. To monitor tornadoes and storms in advance.
8. To monitor sea level due to ice melting and global warming.

4. Classification of robots

A. According to mechanical structure.

1. Cartesian robot [57]
2. Scara robot [58]
3. Articulated robot [59]
4. Parallel robot

B. According to uses

1. domestic use-
2. vacuum cleaning
3. floor cleaning,
4. pool cleaning

C. Entertainment Robots [60]

1. Toys robot
2. Hobby robot [61]
3. Multimedia/remote presence
4. Educational Research

D. Personal Transportation
E. Home security and surveillance
F. According to size.
G. According to medium of movement.
H. According to actuator used.
I. According to fuel used.

5. Classification of Fish robot

According to actuator used

1. Electrical motors like servo motor/stepper motor.
2. Hydraulic actuators.
3. Pneumatic actuators.
4. Ultrasonic actuators.
5. Piezoelectric actuators.

1. Swimming Robots- [62]
   a. Has robotic tail
   b. Frog muscle cells used as muscle wire
2. Festo Fish- Used fluidic Muscles
3. PacX wave guider
4. Swimming Swimanoid Robot. [63]

6. Parts Of Fish Robots

1. A streamlined head.
2. A body
3. Tail
4. The head of robotic [64] fish [111] is carved from a substance called Fiber glass.
5. The head has all the controlling units present in it.
6. The controlling units consists of storage batteries the signal processor, communication module.
7. The body of the robotic [65] fish is made of many smaller parts connected all together with the help of a servo motor.
8. There are pectoral fins attached on the sides of the robotic [66] fish.

7. Electronic Parts Of Fish Robots

1. Arduino Nano.
2. Bluetooth module HC-06
3. Ultra bright LED's.
4. Distance sensor.
5. IR emitter and IR receiver.
6. Battery Pack.(4AA batteries).
7. ON-OFF switch.
8. 3 servo motors.

8. Technological tools used in fish robot

1. Vision camera
2. Modem (for communication)
3. Microphone
4. Data transmission and receiving
5. Robot [67] protection system

9. Tasks performed by fish robot

1. Information about flora and fauna.
2. Information about fish breeds.
3. Types of fishes
4. Number of fishes
5. Water level
6. Silt information
7. Water contamination information
8. Under water plants information.
9. Spy operation in sea near between countries.

10. Under Water Sensors

1. Sensor nodes to measure water parameter.
2. Sediments and pollution sensor nodes.
3. Acoustic sensor.
4. Underwater sensor network architectures.
5. Wired and wireless protocols for underwater sensor network.
6. Localization systems for underwater wireless sensor network.
7. Target tracking using underwater sensor.
8. Optical sensor.
9. Electromagnetic communication sensor.
10. Modems for underwater sensor networks.
11. UWSNs(underwater wireless sensor networks).
12. Underwater sensor communications.

11. Advantages Of Fish Robot

1. It can be used in aquarium as artificial fish.
2. Movements of artificial fish can be controlled in aquariums.
3. No need to give food like actual fishes.
4. More life than an actual fish.
5. No issues regarding animal
6. No need of cleaning aquarium
7. No need to change aquarium water.
8. Less energy is required to operate.
9. Can avoid collision of ship with icebergs and with other ships.
10. Can explore horizons beyond human access.
11. Compact size and less weight.
12. Can withstand cold water and stormy climatic conditions.
13. No impact of snow fall.
14. No impact of water pollution.
15. Less impact on marine life because the robot [68] resembles the fish.

12. statement of Proposed System For Monitoring Oceanic Life

   Vision camera can be fixed on the fish robot [69] to record the flora and fauna underwater. The range of sampling capacity can be varied. The range for movement of underwater fish robot [70] can be increased for data collection from far away locations, as compared to existing fish robots. [71] Microphones can be installed in the robot [72] to record sound vibrations underwater. Size of the fish robot [73] can be adjusted so that there will be plenty of space for modem, so there will not be a concern for modem size. In fish robots, [74] there should be a power backup or power banks. So, at the time of power consumption crisis, it will activate, so that fish robot [75] can work for longer duration. We could install a power saving mode, such that when there is a crisis of power, power saving mode will activate, and will switch off all programs which are not in use like microphones, data transfer module. Nowadays, small size modems are available so we can reduce fish robot [76] size,, so it will consume less power. It should be designed in a way that its size should be small and its outer covering should be like it remains hidden underwater from predatory fish. Outer covering of fish robot [77] should be similar to underwater flora-fauna.

13. Protection System For Fish Robot

1. Protection from fishes
2. Small shocks
3. Vibrations
4. Blinking light
5. Protection from icebergs

14. Application of Fish Robot

1. Monitoring the water level of water bodies.

2. Further it can be used for monitoring the water pollution.
3. Likewise fish robots [78] can be used for entertainment purpose.
4. Also the fish robots [79] can be used to navigate large ships.
5. In the same way the fish robot [80] can be used to explore the rare sea life.
6. For navigating the swimmers in the sea.
7. Furthermore, the fish robots [81] can be utilized for knowing the impact of offshore wind turbine on marine life.
8. It can also help used for assisting the deep sea divers.
9. For carrying out research related to marine life the robotic [82] fish is used.
10. The robotic [83] fish helps in determining the growth rate of marine animals.
11. For instance robotic [84] fish can play a vital role in determining the climatic condition.
12. In addition to this the vision camera of the robotic [84] fish can act as human eye for real time monitoring.
13. Additionally, the robotic [85] fish could help by recording the clips deep inside the sea.
14. More importantly the fish robot [86] would play a vital role in the security purpose of costal border to detect the foreign intruders.
15. It can be used in artificial pond for monitoring the movement of the fish.
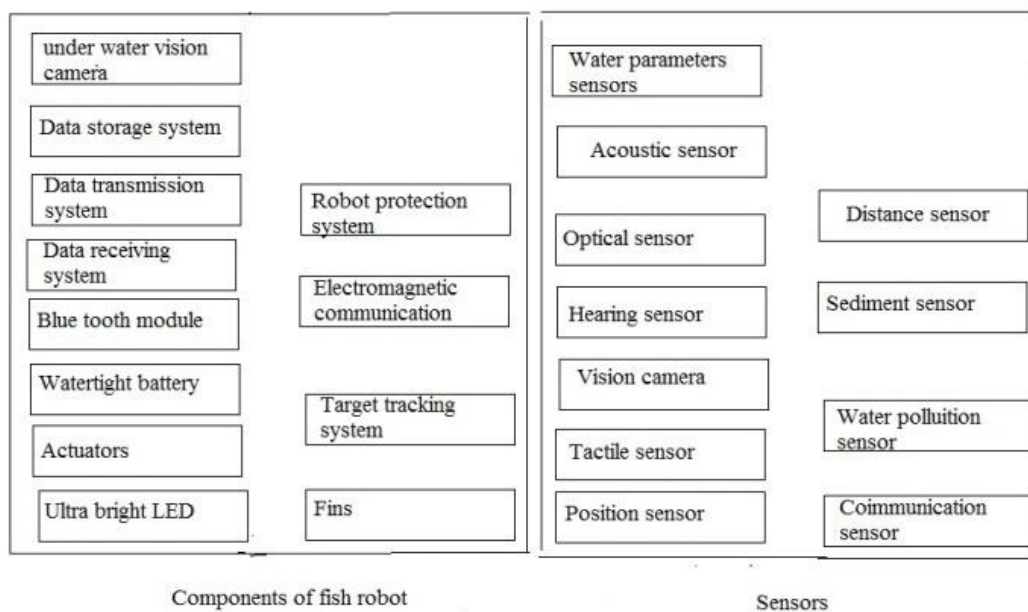

Fig. 1 Block diagram of a fish robot

15. Conclusions

It is concluded that fish robot can be used for monitoring the oceanic life. It can be used for research on fishes. It can be used to monitor the flora and fauna of ocean. It can also be used to monitor the impact of offshore wind turbines on aquatic life of ocean.

16. Acknowledgment

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