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An Innovation development of deep-sea bacterial monitoring and classification based on artificial intelligence microbiological model

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ABSTRACT

The current sea monitoring equipments are being used for a variety of purposes around the world. Currently used vehicles have some drawbacks. The first is the high fuel cost. The Vehicle engines cost more fuel as they have to release more power and environment and pollution. As well as not being able to stay under the sea for long days, there will often be a need for vehicles to come to the surface to refuel. The second is the vibrations and noise of these vehicles. The vibrations caused by these can be detrimental to the biodiversity of the ocean. Also, the noise makes it easier for enemies to identify our vehicles. Similarly when these vehicles go under water, water waves form on the surface. With this in mind, radar can detect what a vehicle under the sea looks like. In this paper, an artificial intelligence based microbiological model was proposed to monitor the sea level. With this biological model can greatly reduce fuels. It can get more capacity than normal vehicles. As fuel consumption decreases, so it does environmental pollution and since it operates quietly and without high vibrations, there is no threat to the biodiversity of the ocean.

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KEYWORDS
Artificial intelligence; biodiversity; environmental pollution; high fuel cost; sea monitoring equipments

1. Introduction

The vast majority of the earth ecosystems live in the oceans. This enormous size is comprised of many species that are not yet fully known. The ocean is a complex three-dimensional world. It covers about 71% of the Earth surface. Habitats of marine life range from surface water to depths of 10 thousand metres or more. Important habitats are coral reefs, golf courses, and sea grasslands. It is surrounded by dunes, hot springs, tidal pools, muddy sand, rocky bottoms, and open seas with no visible objects and waterlogged areas across the border. Among these are the phytoplankton and the largest mammals that can be seen under the microscope. Blue whales are 25–32 metres long or 82–105 feet long. Marine ecology is the study of how marine organisms interact with the marine environment. Sea creatures have a wide variety of resources that can be used as raw materials for food, medicine, and the like. Also used for entertainment and tourism. They play a major role in determining the nature of our planet. Make a significant contribution to the oxygen cycle. Beaches are created and protected by certain types of marine life. Many species are economically important to humans. Studies of vital cycles in the ocean and oceans are on the rise. It is like the breath of the earth. Large areas beneath the ocean are still unknown [1].

Microscopic algae and plants provide habitats for organisms. Sometimes they are hiding places for the larvae of large fish. It is known that there were a total of 33,400 species of fish in 2016. About 60% of the species live in salt water. Bark including jellyfish and sea marigold, niteria, sea worms, nematria, ringworms, chipunkula, mollusks, starfish; and there are over a million species of invertebrates, such as the sea urchin. More than 1500 species of fungi are known from marine environments. They are also found in marine algae, animals, corals, protozoan cysts, sea grass, wood and seawater. Abnormal secondary metabolites are produced by marine fungi. Rocks are the densest and most diverse habitats in the world. Corals are also found in cold water. Corals are made up of animals made of coral and other calcium. The coral reefs suffered the most severe destruction. The catastrophe was caused by rising sea surface temperatures. Some reefs have been restored,

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and 50% −70% of the world coral reefs are at risk of global warming. Researchers predict that this condition could worsen [2]. Ocean development is the traditional use of the ocean, i.e. the effective use of the ocean in new fields other than conventional fisheries, maritime transport, ports, terrain, and exposures. The term “marine development” began to be used. In particular, the scope of the survey covers not only biological resources, oil and gas resources, but also various sectors such as utility and environmental protection. However, the ocean is vast and knowledge of its behaviour and seas is still inadequate. Therefore, the use of the ocean will require research and exploration of the ocean, and further technological development is needed to make marine use economically viable [3].

In addition to the regular use of ports, landscapes, recreation and sea routes, the extensive use of oil reserves, seaports, marine vegetation, Tokyo bridges and marine artificial islands is considered. As the depth of water increases from shallow water to the sea, the cost of construction increases and becomes technically difficult [4]. In Japan, however, land use is narrow, so efforts are being made to realize what is needed in terms of social needs and the economy [5]. When humans enter the ocean and work, the pressure of the air or mixture inhaled is equal to the pressure similar to the depth of water, so the gas dissolves in the human body. When the work is done, the pressure decreases as it rises to the surface of the ocean, so that the dissolved gas in the human body is expelled out of the body, but if the pressure is reduced rapidly, the nitrogen bubbles up and causes many obstacles [6,7]. To prevent this, it is necessary to gradually reduce the pressure, and the time to reduce the pressure is prolonged as the depth of the water is deeper and the stay time is longer. For example, if you dive to a depth of 100 m and work 2 h, it takes about 15 h to reduce the pressure to atmospheric pressure [8]. To improve this, the submarine housing project was considered. If a living space is set up at sea and the internal pressure is equal to the depth of the water, divers work at sea, return to the living space, relax and return to work. On the other hand, diving performance has been significantly improved since the depressions have to be done only once when returning to the sea surface [9,10].

Marine algae are used medicinally, as are many of the plants that grow on earth. “Agar agar” is derived from algae such as Crazy, Laria, and Azirosa. It is used to process bread, cheese, etc., and to process meat, fish, etc. canned. Spirulina moss is high in protein and other nutrients. It can be easily digested. Studies show that they help people with diabetes to prevent the spread of diseases such as cancer and AIDS [11]. The Seaweed, also known as Kipnia nidipica, is used to treat a variety of stomach ailments and headaches. A seaweed called Drusilla cures skin disease. In general, the role of the thyroid gland in pregnancy is very high. Fertility is definitely delayed if the thyroid is not getting the right amount of nutrients [12]. Adding fish and seaweed “Agar Agar”, a white seaweed, to the diet can help regulate the thyroid. The certain types of algae can prevent cancer, diabetes, tuberculosis, arthritis, iron deficiency, menstrual disorders and bleaching. Seaweed is increasingly being exported to foreign countries [13].

Humans use certain types of bacteria because they need them. For example, bacteria can be useful in making milk and brewing sweet juices. Many cheeses get their delicate taste from bacteria. The main mass of “friendly” microorganisms in the gut is phytobacteria (85-95%). The rest are lactic acid bacteria, E. coli, enterococci and other non-pathogenic or conditional pathogenic bacteria. When dysbacteriosis occurs, the number of phytobacteria is often reduced. To prevent dysbacteriosis, kefir and yogurt fortified with Phytobacteria, as well as live yogurt are used. The Probiotics are used to treat. They contain more than 10 million bacteria, and the most powerful – up to billions [14].

The system’s capabilities in bacterial identification and monitoring could have applications in various fields, including environmental conservation, medical research, and industrial processes where understanding bacterial activity is essential. For thousands of years, humans have been using lactic acid bacteria to make many dairy products. If you add different bacteria in the milk, you will get cheese, yogurt, kefir, yogurt, cheese. The Bacteria are widely used in the food industry for sauerkraut (in this case, organic acids are formed). Bacteria are used to treat wastewater from minerals (primarily copper and uranium), organic waste, and silk and leather processing, to control agricultural pests, and to produce drugs (e.g. interferon). Some bacteria settle in the digestive tract of plant mammals, ensuring fibre digestion. Two important environmental functions of bacteria are nitrogen fixation and mineralization of organic residues [15]. The formation of ammonia (nitrogen fixation) by the binding of molecular nitrogen by bacteria and the nitrification of ammonia is an important process because plants cannot absorb nitrogen gas. Approximately 90% of the bound nitrogen is produced by nodular bacteria that coexist with legumes. The Bacteria bring not only good but also bad. They multiply in food and thereby spoil. To stop breeding, the products are pasteurized (kept at a temperature of 61–63 C for half an hour), stored in a cool, dry place (drying or smoking), salted or pickled. Bacteria can cause serious illness in humans (such as tuberculosis, anthrax, tonsillitis, food poisoning, and gonorrhoea), animals and plants (for example, bacterial blight on apple trees). Favourable external conditions increase the rate of bacterial reproduction and cause infections. Pathogenic bacteria enter the body through airborne droplets, wounds and mucous membranes, the digestive tract. Symptoms of bacterial infections are usually explained by the action of toxins produced by these microbes or by their destruction [16].

In aquatic ecosystems, the presence of heterotrophic bacteria, whether in fish or pond chemical products, can significantly influence water quality and the overall health of the ecosystem. Heterotrophic bacteria play a crucial role in the decomposition of organic matter, contributing to nutrient cycling. If their population becomes imbalanced, it may lead to shifts in microbial communities, affecting the breakdown of pollutants and organic compounds. Understanding whether these bacteria are aerobic or anaerobic is essential for managing water environments. Aerobic heterotrophic bacteria require oxygen, contributing to the breakdown of organic matter in well-oxygenated environments. On the other hand, anaerobic heterotrophs thrive in low-oxygen or oxygen-deprived conditions, influencing decomposition processes in oxygen-poor zones. Balancing these microbial communities is critical for sustaining a healthy aquatic ecosystem and ensuring water quality for both aquatic life and potential human use.

2. Literature review

It [2] discussed in addition, there are two researches in the development of large full-scale wave power generation equipment, one floating in the ocean and the other adjusting on the beach. They [4] discussed in addition, seawater has many rare resources, but future significant ones include uranium (3 ppm) and lithium (0.17 ppm), and heavy water for fusion reactors. Uranium has accumulated through absorption, and further experiments have been carried out to produce yellow cakes by saturation. Practical application is expected. Author [6] discussed the seas are essential not only for fishermen but also for the daily lives of all the people of the world. The seas that provide the fresh air we breathe and the nutritious food we eat are the lifeblood of the world economy and the livelihood of ordinary people. Author [8] expressed the seas serve as travellers to many countries and international trade routes. Marine resources play a vital role in the lives of people in such a wide variety of ways. Marine resources play an important role in the economic development of a country. They [12] discussed the number of bacteria in the air of ventilated and non-ventilated rooms are different. The living conditions of bacteria are different. Some of them need air oxygen; others do not need it and are able to live in an oxygen free environment.

The proposed model aims to reduce fuel costs, environmental pollution, and threats to ocean biodiversity by utilizing artificial intelligence for sea monitoring, presenting a more sustainable and efficient approach. Also, it addresses challenges such as high fuel costs, vibrations, noise, and the need for frequent resurfacing by introducing a biological model that operates quietly, reduces fuel consumption, and poses no threat to ocean biodiversity.

3. Proposed method

The proposed deep sea bacterial monitoring (DSBM) system architecture was shown in below Figure 1. Initially the details are sliced into three different parts. They are the surface monitoring, intermediate monitoring and depth monitoring. In this surface monitoring module, the surface level bacterial information is continuously monitoring and updated in the data base.

Then the intermediate module gets the information about the different bacteria once the surface details are updated in the database.

Then the depth sea module was also getting the information via the database. Once the input details are captured by the system, then it goes to segment each and every details as a small segmentation then its starts to poling the details as per the dataset. After successfully completed the pooling then these details are send into the localization and normalization units for verification. Then finally the deep sea level monitoring algorithm checks and evaluate the score this shown in Figure 2. Once the scores are matched the database and data set values then this will confirm the output bacterial information. Figure 3 shows the proposed system block diagram of our study.

Sea Bactria dataset:-

- General Bacteria: a cellular microenvironment, a group of organisms. Along with blue–green algae, b. represents the kingdom of the Prokaryotes and the Super-Kingdom
- Frog spawns bacteria- frogspawn bacteria: The bacterium causes the butyric fermentation. The Sacrolytic Clostridia, producing anaerobic spores
- Bacterial "stem" – Bacterial "stem" Bacteria that form growths (stems) that attach to the substrate and water patterns. Representatives of the genus Colobacter are an example. Bacteria are a large group of bacteria that acquire growth potential through the aerobic oxidation of hydrogen-H2 and carry out the synthesis of CO2 (chemical compound).
- Sea Bacteria – Bacteria, when grown in specialized substrates, can form gases – H2, CO2, etc. Usually this property is used as a diagnostic feature.
- Biogenic Bacteria- staphylococci, streptococci and other pathogens of local purulent inflammation or common infection of the body of animals and humans (sepsis).
- Green Bacteria are green-phototrophic bacteria whose cultures generally have a corresponding colour. Representing two families. Chlorophyceae is a single-celled, wire-shaped bacterium.

- Knot Bacteria- Rhizobium, Pteridrisobium, Azorisobium, Synorhysobium, nitrogen-fixing symbiotic bacteria that form nodules on the roots of legumes.

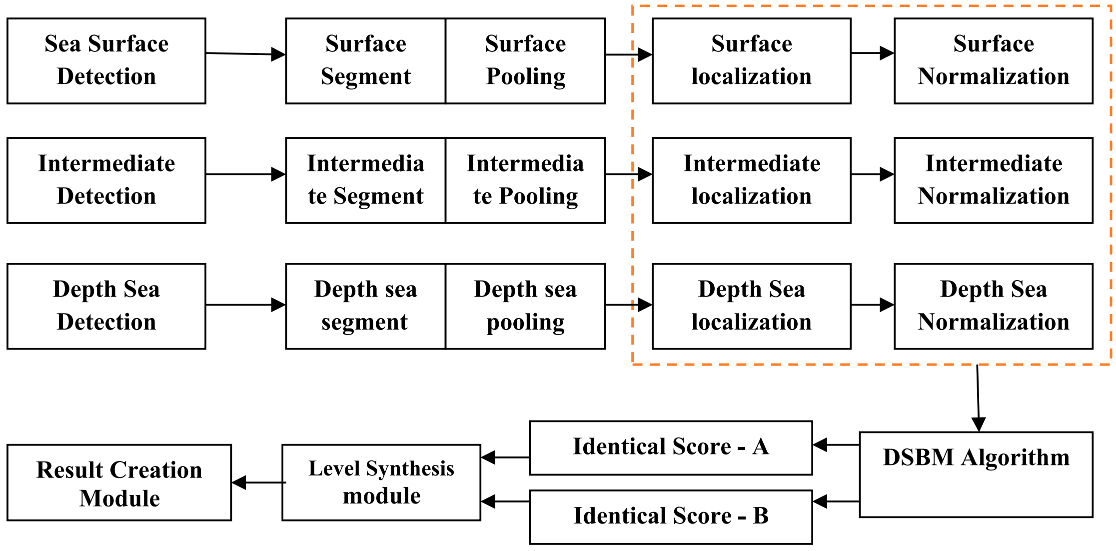

Figure 1. Proposed system design.

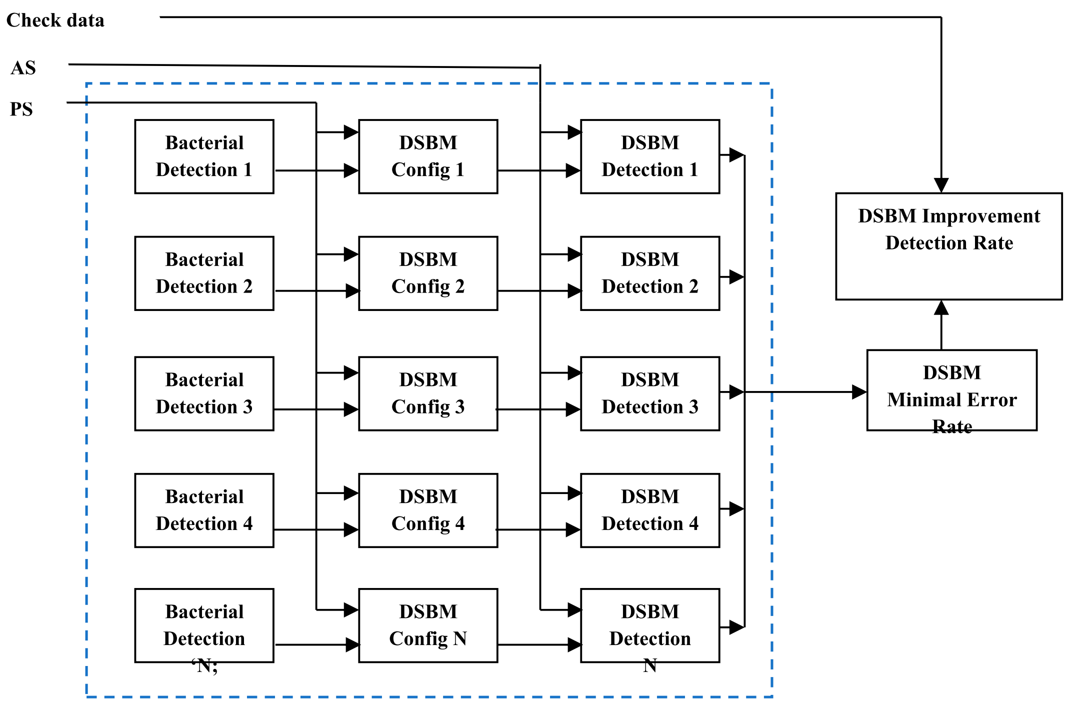

Figure 2. Monitoring and identification of detection rate.

- Crystalline Bacteria bacillus thuringiensis is a bacterium that causes disease in insects. They contain large crystals of end toxin in the cell, which got their name
- Lysogenic bacteria – Bacteria with phosphates in the proboscis state capable of producing mature page particles after being stimulated by antibiotics, temperature, ultraviolet and radiation
- Mesospheric bacteria – The optimum temperature for bacterial growth is within 2 4 —42 C; Most are soil and aquatic organisms.
- Methane-Oxidation- Bacteria that use methane as a source of energy and carbon. Gram-negative, movable and immobile, spherical, rod-shaped or vibroid
- Lactic acid Bacteria – Bacteria such as Lactobacillus and Streptococcus produce lactic acid during the fermentation of carbohydrates. Facilitative anaerobes, Gram-positive stems and hooks, do not produce spores
- Fibre Bacterial – Bacteria that grow in the form of long filaments with chains of cells. Often they have a common mucus capsule. A common representative is the bacterial Leptotrix of iron.
- Prop ionic acid Bacteria – Bacteria of the genus Propone-Bacterium ferment carbohydrates with the formation of prop ionic and acetic acids. Inhabitants of the rumen and intestines of ruminants

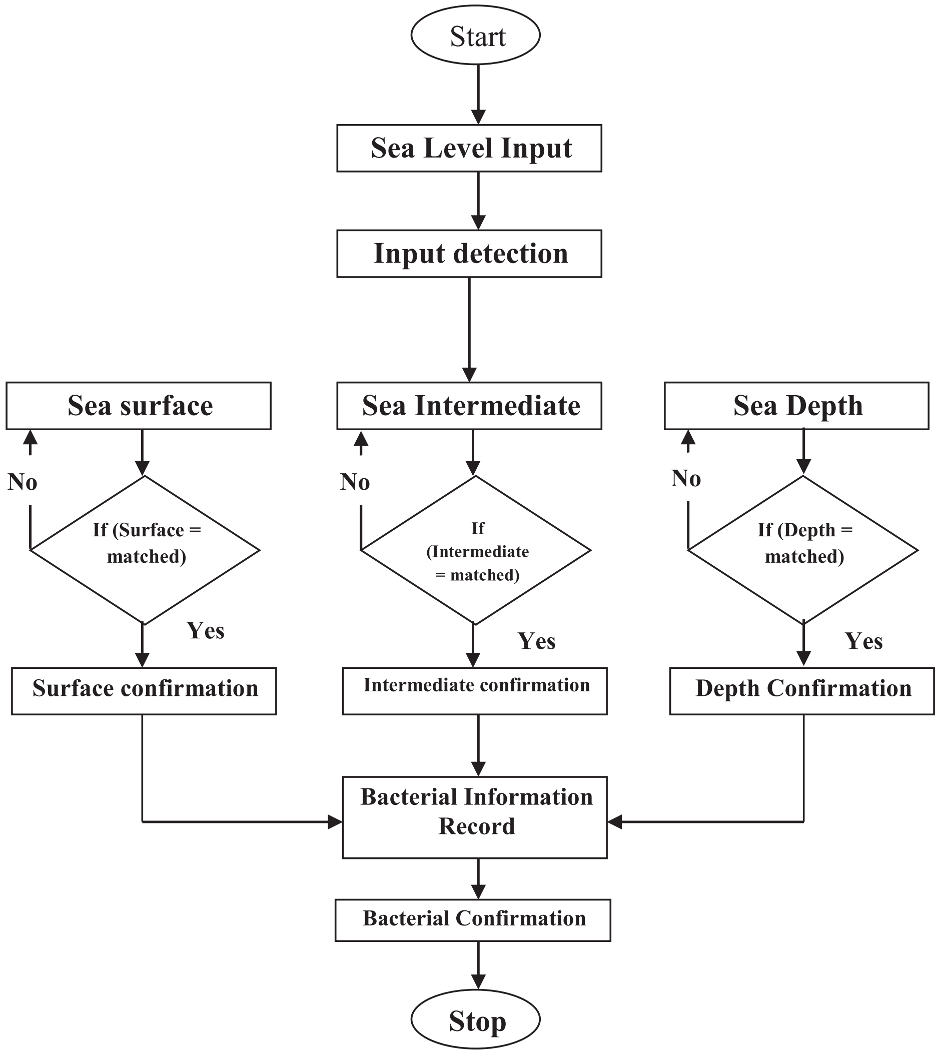

Figure 3. Proposed system block diagram.

Algorithm 1: Deep Sea Bacterial Monitoring (DSBM)

```
Initialize the sea level input
Store the input sea level values and send it for calculation
Enter surface level details
   IF (surface = matched)
   Then confirm the surface level bacteria
   Else (request to enter the correct surface details)
Enter intermediate details
   IF (intermediate = matched)
   Then confirm the intermediate bacteria
   Else (request to enter the correct intermediate values)
Enter depth sea details
   IF (depth sea = matched)
   Then confirm the depth sea bacteria
   Else (request to enter the depth sea values)
Confirm the bacteria information
Store the bacteria information
End
```

- Bacteria Cyclophilic – Cryophilic bacteria – bacteria that grow at high speeds below 2 ° C. For example, some marine glowing bacteria, iron bacteria (gallionella).
- Bacteria are a group of urophototrophic bacteria. By morphology – cocci, wires and curled shapes, immobile and mobile due to flagella, gram-negative. They reproduce by division and proliferation.
- Bacterial saprophytic – (us. Saprophytic) – A bacterium that converts dead organisms into organic matter, ensuring the circulation of substances in nature.
- Bacteria Fluorescent – Chemical bacteria capable of bioluminescence (Genara photobacterium, Penecia) in the presence of oxygen. Marine shapes in general
- Sulphate-reducing bacteria – Sulphate-reducing bacteria, Sulphate reducers – Physiological group of bacteria that reduce sulphate to hydrogen sulphide under anaerobic conditions
- Bacteria Thermophilic – Bacteria that grow well at temperatures above 40 C; In most cases, the upper temperature range is 70 C.

The proposed deep sea bacterial monitoring system stands as a transformative tool with significant implications for the development of marine resources and ocean exploration. By offering accurate and eco-friendly sea monitoring capabilities, the system

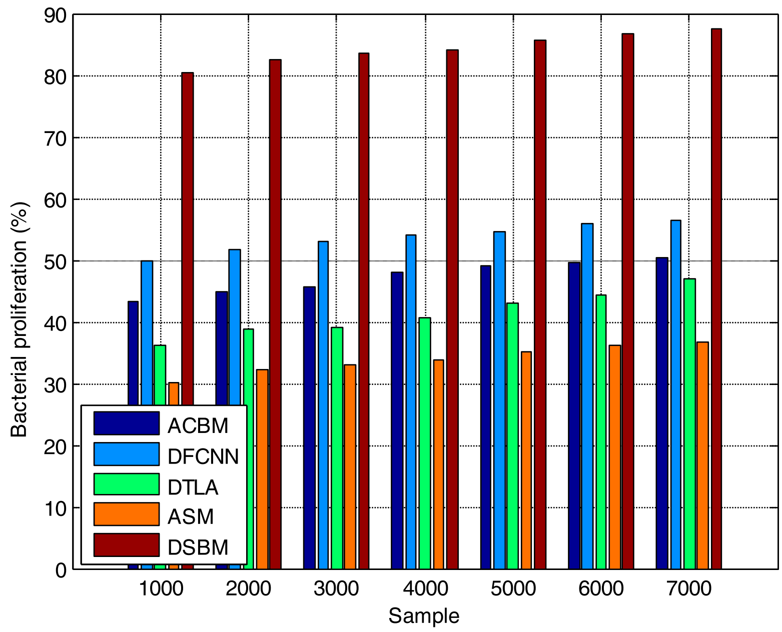

Figure 4. Comparison of bacterial proliferation.

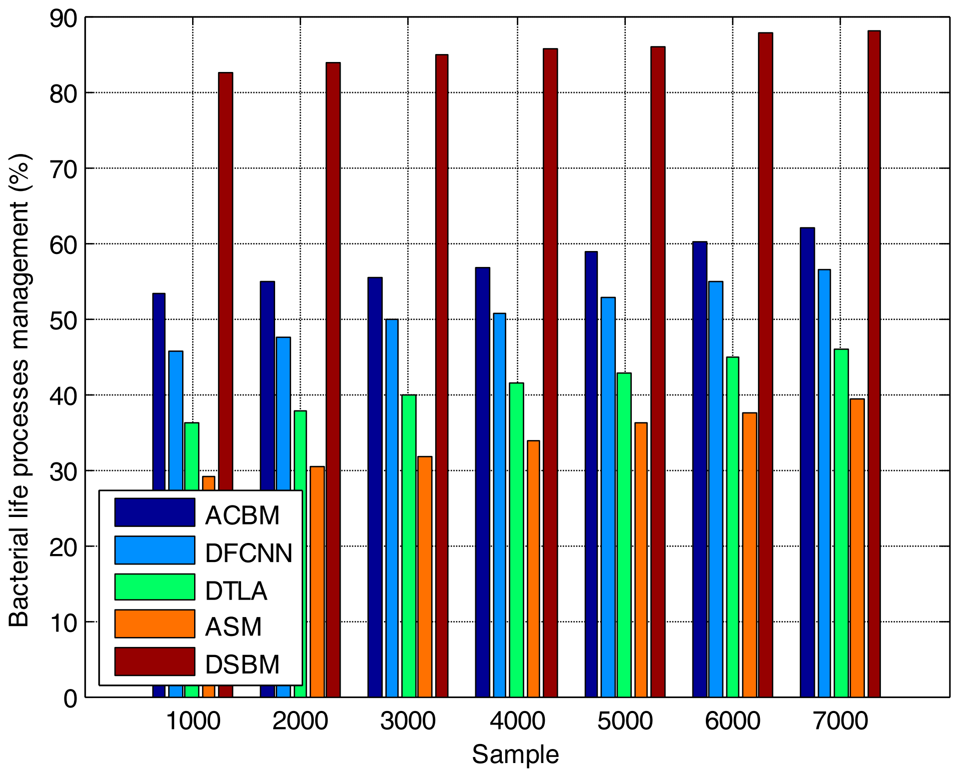

Figure 5. Comparison of bacterial life processes management.

becomes instrumental in fostering responsible practices. Its ability to precisely identify and assess bacterial components in the ocean allows for informed decision-making, ensuring that marine resources are harnessed sustainably. This not only mitigates the environmental impact but also promotes the long-term viability of marine ecosystems. Furthermore, in the realm of ocean exploration, the system's effectiveness enhances our understanding of the intricate marine environment, opening avenues for scientific discovery and uncovering potential novel resources. Overall, this technological advancement heralds a new era in marine resource management, aligning with a commitment to ecological preservation and sustainable utilization.

4. Results and discussion

The proposed deep sea bacterial monitoring (DSBM) was compared with the existing Advances in chemical and biological method (ACBM), An improved deep fusion CNN (DFCNN), A deep transfer learning approach (DTLA) and Activated sludge monitoring

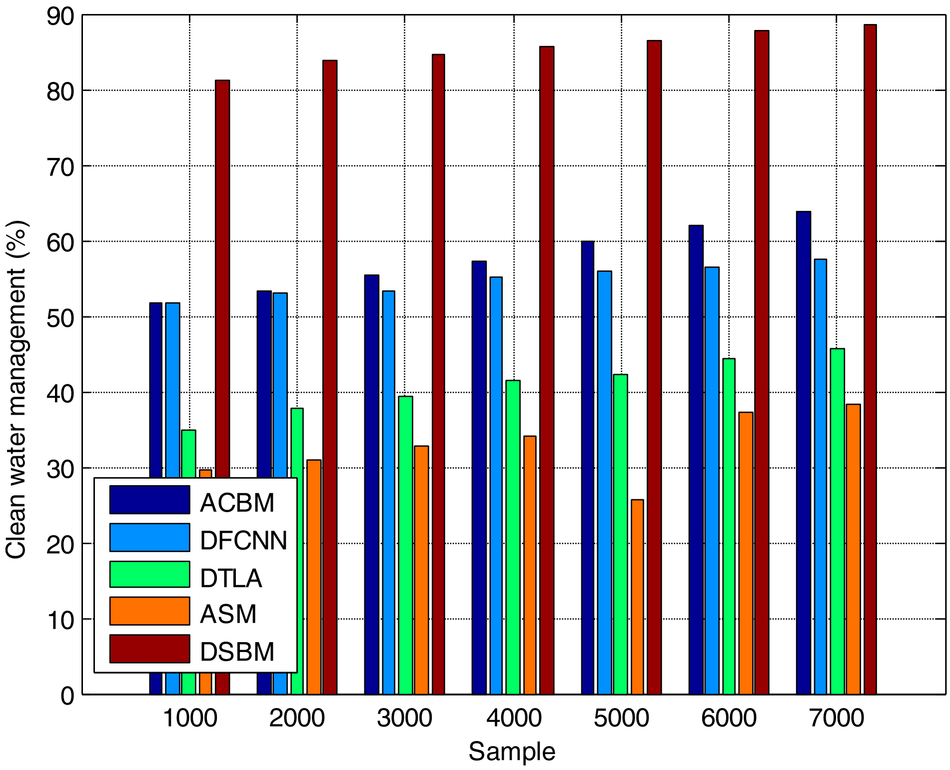

Figure 6. Comparison of clean water management.

Table 1. Deep technical model for sea bacteria identification.

Characteristics	Issues	Eco-friendly	Bio-optical polymer
Sensitivity	No	Yes	Yes
Smaller size	No	Yes	Yes
Depth of the area	Average	Low	High
Identification	Average	Low	Low

(ASM). Table 1 shows the Deep technical models for sea bacteria identification.

4.1. Bacterial proliferation

There is no place on earth where bacteria do not occur. They are especially high in soil. 1 gram of soil may contain millions of bacteria. There are also a lot of bacteria in the human body. Man is made up of human cells and life forms of bacteria, fungi and viruses. Figure 4 shows the comparison of bacterial proliferation. The human body contains many trillions of cells and more than 100 trillion bacteria, of which there are about five hundred species. Especially in the intestines there are a lot, they help to cope with food: they digest it, as well as in the respiratory tract, skin and urinary system. They live in air, seas and ocean waters, tolerating deep frosts and high temperatures (Figure 5).

4.2. Bacterial life processes management

Most bacteria are colourless. Only a few of them are purple or green. Bacterial cells are surrounded by a dense membrane, thanks to which they maintain as Figure shape. The composition and structure of the shell of bacteria differ significantly from those of plants and animals. There is no nucleus separated from the cytoplasm by a membrane. The nuclear material in most bacteria is distributed in the cytoplasm. Bacteria reproduce by separating approximately every 20 min (under favourable conditions). Every daughter cell is a copy of the parent. Reproduction is inhibited by the sun rays and the products of their own vital function. The behaviour of bacteria is not particularly complicated. Chemical receptors record changes in the acidity of the environment and the concentration of various substances: sugars, amino acids, and oxygen. Many bacteria react to changes in temperature or light, and some bacteria can sense the Earth magnetic field.

4.3. Clean water management

Water plays an important role in the life of all living things. The water should be clear, colourless and odourless. The sponge is in a warm place, constantly moist. This will make it a convenient place for bacteria to grow. Figure 6 shows the Comparison of Clean water management. Therefore, you should: Take a sponge only with clean hands; Wash and press the sponge after use; Store the sponge in a clean, ventilated area; do not leave the sponge in the sink.

4.4. Collaborative relationship

These are relationships that are beneficial to the bacteria but do not help or harm the human host. Most

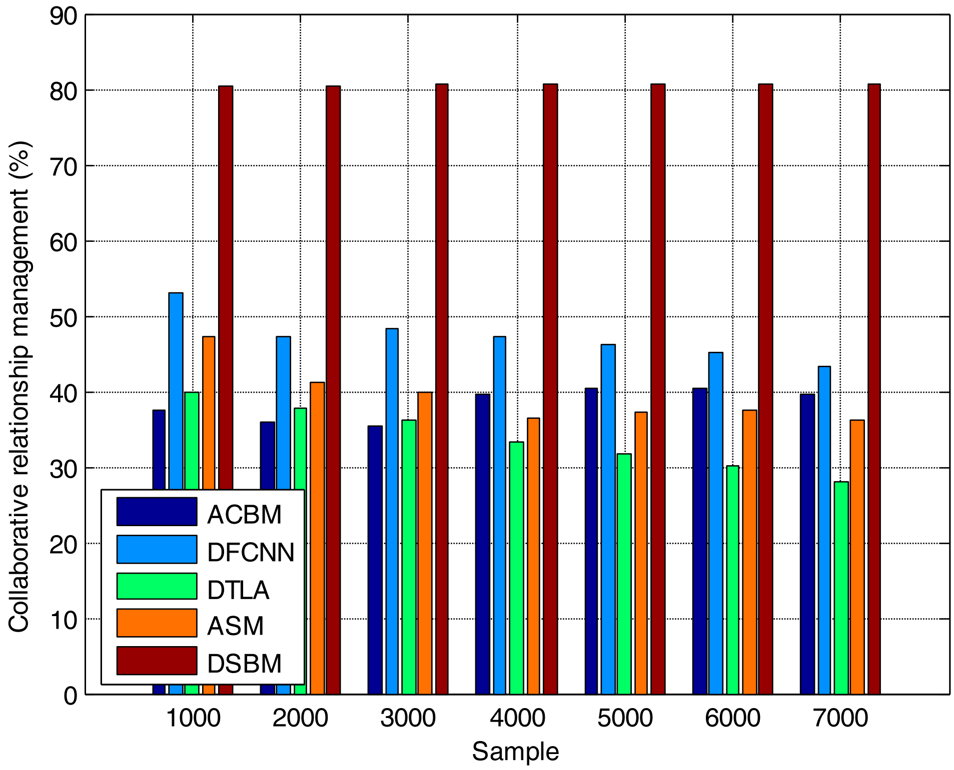

Figure 7. Comparison of Collaborative relationship management.

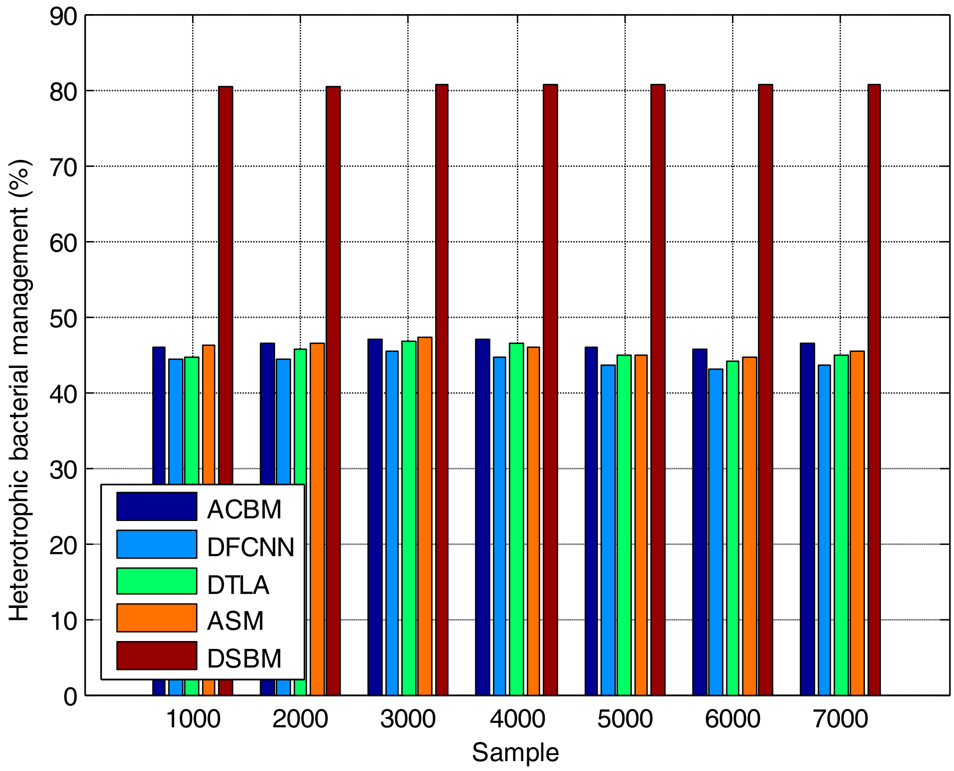

Figure 8. Comparison of Heterotrophic bacterial management.

early bacteria are found on the epithelial surfaces in contact with the external environment. They are commonly found on the skin, respiratory and gastrointestinal tract. Early bacteria derive from host nutrients, which is a place to live and grow. Figure 7 shows the Comparison of Collaborative relationship management.

In some cases, it can become an early bacterium and cause disease or benefit the host. A type of relationship that benefits both bacteria and the host. For example, many types of bacteria live in the skin, mouth, nose, throat and intestines of humans or animals. They get a place to live and eat; instead they prevent the spread of harmful germs.

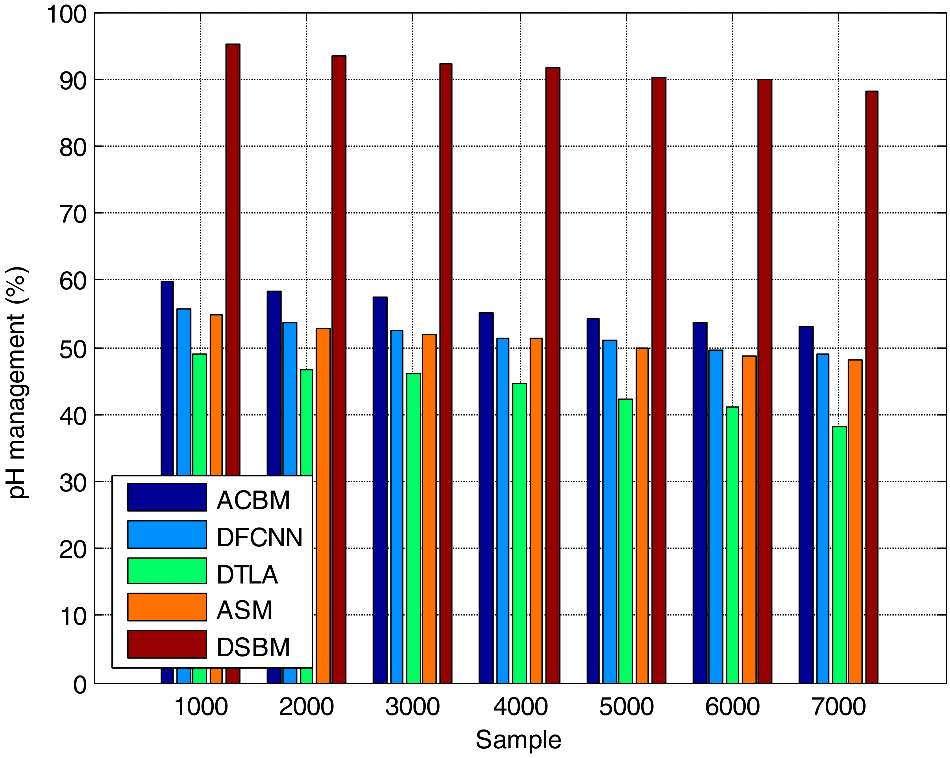

Figure 9. Comparison of pH management.

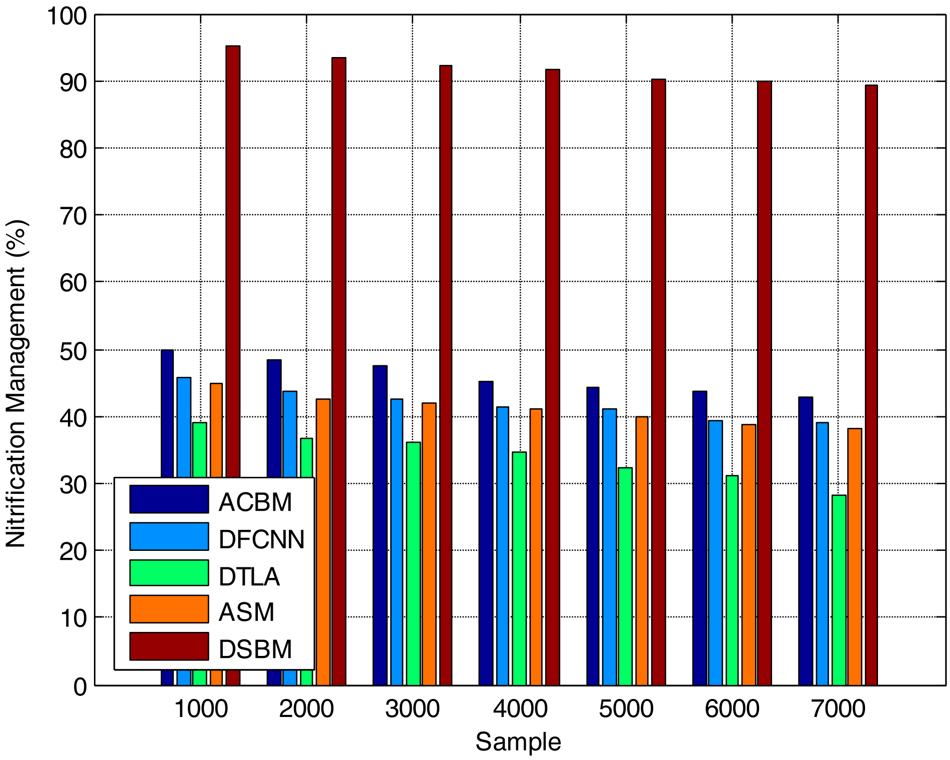

Figure 10. Comparison of comparison of nitrification management.

4.5. Heterotrophic bacterial management

An organic molecule is needed to extract carbon from heterotrophic bacteria and grow further. Some of these bacteria are strictly aerobic, but many are anaerobic (can survive in the presence or absence of oxygen). Heterotrophic bacteria are also present in many fish or pond chemical products. These bacteria can be Gram-positive or Gram-negative. Figure 8 shows the Comparison of Heterotrophic bacterial management. Consequently, using Pseudomonas as an example, the use of gram-negative agents such as kanamycin in fish can have a strong negative effect on Pseudomonas, but it does not affect the autotrophic nitrifying bacteria.

4.6. pH Management

It should also be noted that pH affects the bacteria involved in the nitrification process. Nitrification involving AHB and NOB has different ratios below pH 6.0 and above 7.0. Toxic ammonia (NH3) itself is converted to ammonium (non-toxic NH4) at pH 6.0, and ammonium is converted to toxic NH3 again at pH above 7.0. Figure 9 shows the Comparison of pH management.

4.7. Nitrification management

The nitrification rate decreases rapidly from 6.0 below 7.0 or higher with a pH increase to a certain point, after which the nitrification rate appears to resume / self-heal, but already at an increased pH value. The mechanisms of the relationship between nitrification rates and pH are not yet fully understood. Figure 10 shows the Comparison of Comparison of Nitrification Management.

5. Conclusion

In general, the surface of the sea has many living organs and bacteria. These are created some more good impacts and most of them are not identified. These are also non understandable bacteria and these impacts of the sea surface are not predictable. Hence the issues and the problems among this are getting high priority while their impacts are massive. The proposed deep sea bacterial monitoring (DSBM) was compared with the existing Advances in chemical and biological method (ACBM), An improved deep fusion CNN (DFCNN), A deep transfer learning approach (DTLA) and Activated sludge monitoring (ASM). The proposed predictions and motoring are getting higher results while comparing the other models. The natural defenses of human and superior animal organisms are based on the bacterial phagocytosis of white blood cells and the immune system, which produces antibodies that bind and remove foreign proteins and carbohydrates from the bloodstream. In addition, there are natural and synthetic drugs against bacteria.

Disclosure statement

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