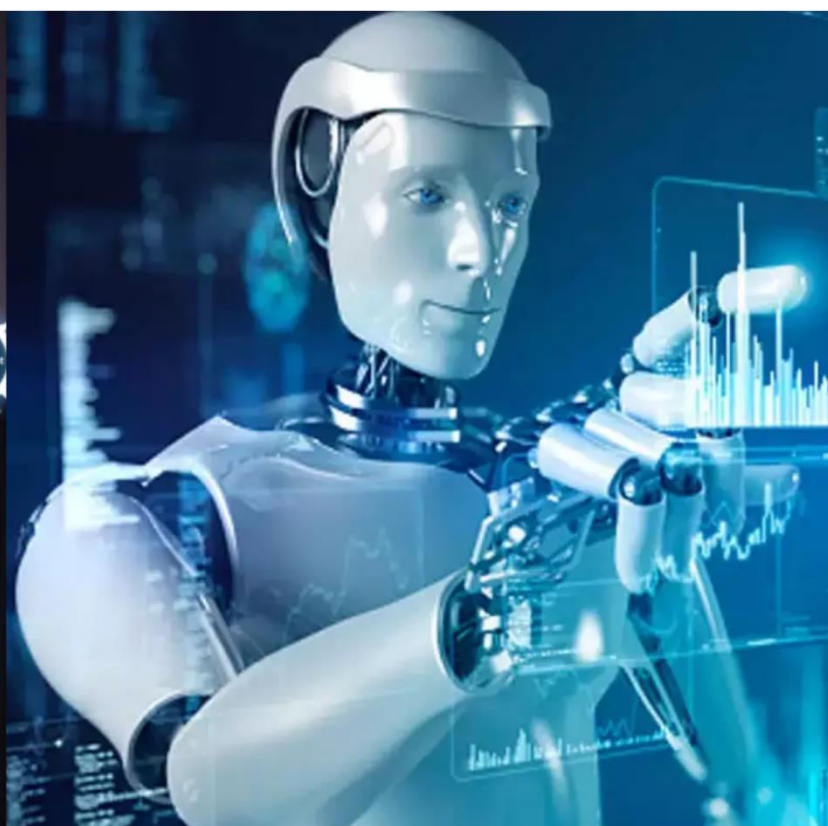




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# **Implementation of Energy Efficient in Underwater Wireless Sensor Network using Deep Learning**

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**ABSTRACT:** Underwater Acoustic Sensor Network (UWASNS) is an emerging technology consisting of sensor nodes and autonomous underwater vehicles (AUVs), all working in collaboration with a variety of phenomena, processing digital information, storing processed data, communicating with each other, and communicating with basic stations. In this project, the performance of the reinforcement learning (RL) algorithm allows dynamic energy path selection by analyzing the tools of Network Simulator 3 (NS3) for ambient changes in the underwater acoustic network environment. I used 40 knots, including diver and AUV sensors. The source signal is sent to the cluster to ensure energy efficiency. We used power metrics such as sensor node package tax ratio, average end-to-end latency, throughput, and energy consumption. The use of deep learning algorithms predicts the speed of the underwater acoustic signal. Underwater parameters including depth, temperature, salinity and pressure are used to predict the rate of underwater signal transmission. This allows for energy-efficient, safe signalling underwater.

## **I. INTRODUCTION**

The Underwater Acoustic Sensor Network (UWASN) is in the foreground of aquatic exploration, using sensor nodes and unmanned vehicles (AUVs) to recognize, process and communicate with each other in aquatic environments. The network consists of 40 nodes, including scuba diving and sensors in AUVs, which focuses on energy-efficient signaling and robust security measures. Malicious node detection protects against potential threats to enhance signaling security used for encryption. Signaling is organized in clusters to optimize energy consumption. This is very important in resource-related underwater domains. Performance metrics such as package tax ratio, average end-to-end latency, throughput, and energy consumption are systematically analyzed to measure the effectiveness of reach protocols in this unique underwater context. A distinctive feature of this project is the integration of algorithms for machine learning to predict underwater signal speeds. By using underwater parameters such as depth, temperature, salinity and pressure, deep learning models improve network adaptability to a variety of conditions. This innovative approach contributes to achieving energy-efficient, safe acoustic signaling in underwater environments, and has potential impacts on a variety of applications in marine research and environmental surveillance.

## **OBJECTIVES**

The purpose of this project is to assess the performance of the reach protocol in the context of an underwater acoustic sensor network (UWASNS). Assess the effectiveness of laughter protocols in promoting reliable and efficient communication between small and intelligent battery-controlled sensors and underwater devices such as vehicles.

## **II. LITERATURE SURVEY**

[1] Mohammad Alsulami, Raafat Elfouly, Reda Ammar "Deployment of Multiple Computing Systems in Underwater Wireless Sensor Networks ", 2020. However, limitations in resources and equipment have prompted further exploration. In a related study, researchers proposed two novel approaches/algorithms to enhance the capabilities of AUVs in UWSNs. The first algorithm adopts a bottom-up clustering approach, grouping master nodes in the network based on communication range. The goal is to distribute the processing load across multiple computers to address the limitations

of a single node. In the second algorithm, nodes are deployed both homogeneously and heterogeneously, introducing additional constraints to better reflect real-life scenarios. This approach aims to optimize resource allocation and improve the efficiency of the underwater monitoring system.[2] L. Als Salman, E. Alotaibi, "A Balanced Routing Protocol Based on Machine Learning for Underwater Sensor Networks" 2021. An underwater sensor network (UWSN) is a wireless network that is deployed in oceans, seas, and rivers for real-time exploration of environmental conditions. The network is used to measure temperature, pressure, water pollution, oxygen level, volcanic activity, floods, and water streams. Although radio frequency (RF) is widely utilized in wireless networks, it is incompatible with the UWSN environment; therefore, other communication mechanisms have been employed to manage the underwater wireless communication among sensors, such as acoustic channels, optical waves, or magnetic induction (MI). Unlike terrestrial wireless sensor networks, UWSNs are dynamic, and sensors move according to water activity.

### **III. EXISTING & PROPOSED SYSTEM**

#### **1. EXISTING SYSTEM**

Underwater - Wireless Sensor Networks (UWSN) offers considerable potential for researching and using marine resources. However, it also comes with some challenges and drawbacks. First, water attenuates the wireless signal. Limited communication area and range limits can lead to linking sensors for bandwidth routes. Data transmission. Inquiries or replacing batteries in underwater environments are extremely difficult and limits the operating time of the network. Localization or determination of the location of sensor nodes is also due to dynamic ocean flow and signal weakening. Over time there are temperatures that can affect all hardware, leading to potential network errors. Another limitation is that these sensors have limited memory and processing power. This limits the ability to manage large amounts of data, especially for real-time applications such as military surveillance and pollution.

#### **3.1 DISADVANTAGES**

- Underwater Wireless Sensor Network (UWSNS) faces major challenges, including limited communication and scope due to weakening of water signals that affect data transmission. Energy consumption is a serious issue.
- This is because charging or replacing batteries in hard underwater environments is difficult and reduces network lifespan.

#### **2. PROPOSED SYSTEM**

The proposed system is built on reinforcement learning and introduces improvements and adjustments to address unique challenges in the underwater environment. This model is designed for 40 nodes representing sensors in autonomous underwater vehicles. The focus improves adaptability, security, energy efficiency and overall performance. Advanced security measures such as intrusion detection and visualization of malignant nodes are integrated into the proposed system. Energy efficiency can be used to take into account parameters such as depth, salinity, salinity, temperature, speed expression, speed drive, speed, power supply speed, power supply speed, power supply speed, power supply speed, power supply speed, power supply speed, strength transfer, power supply speed, etc.

#### **3.2 ADVANTAGES**

- The proposed system leverages Reinforcement Learning to enhance adaptability, energy efficiency, and security in Autonomous Underwater Vehicles with 40 sensor nodes.
- By clustering signal transfer and integrating advanced security measures like intrusion detection, it improves overall performance.
- Additionally, the use of a Reinforcement algorithm to optimize signal transfer speed based on environmental parameters achieves 98.8% accuracy, boosting communication efficiency.

### 3.3 BLOCK DIAGRAM

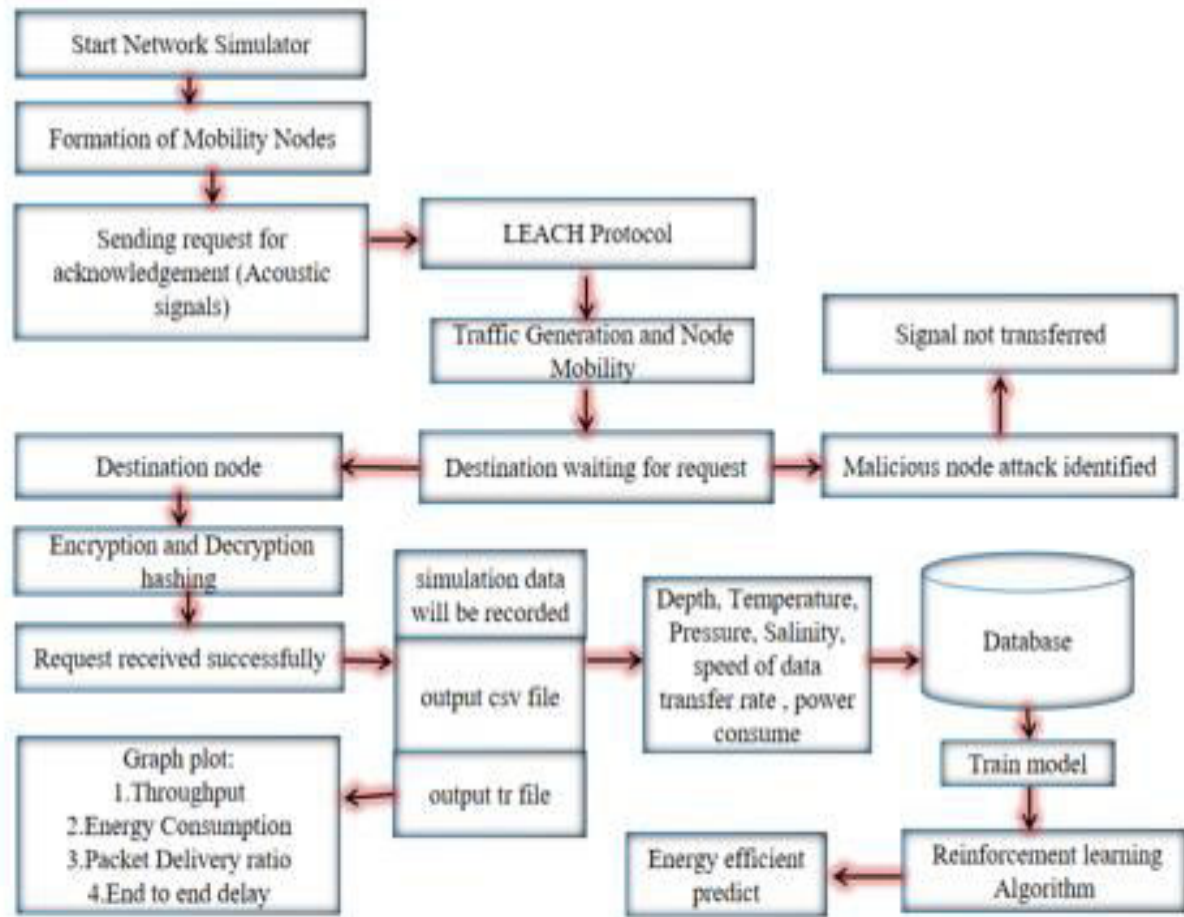


Fig no: 1 Block diagram for proposed method

### IV.WORKING PROCESS

#### Network Setup:

The UWASN consists of sensor nodes that are included with divers and used under water, including autonomous underwater vehicles (AUVs).

#### Reach Protocol:

Leach (Low Energy Adaptive Clustering Layer) is a hierarchical routing protocol that optimizes the energy consumption of wireless sensor networks (WSNs) especially for applications such as monitoring and data collection. In Reach, the network is organized into clusters, each cluster has a specific cluster head (CH) that is responsible for aggregating data from the cluster's sensor nodes and forwarding it to the base station.

#### Cluster-Based Data Transfer:

Data transmissions to the cluster are organized to ensure energy efficiency. In clustering, in a cluster group of nodes, each cluster has a cluster head, and is responsible for coordinating communication within and with other clusters.

### Malicious Node Recognition:

The project includes a mechanism for recognizing malicious nodes in the signaling path. This includes techniques such as abnormality recognition and behavioral analysis, which attempts to identify nodes with suspicious behaviors and disrupt communication.

### Performance Evaluation Metrics:

Various power metrics are used, such as assessing the performance of UWASN laughing protocols, such as package ratios, average end-to-end latency, throughput, and sensor node energy consumption. These metrics provide insight into the efficiency, reliability and energy consumption of communication systems.

### Deep Learning for Speed Prediction:

Deep learning algorithms are used to predict the speed of an underwater signal transmitter. Features such as depth, temperature, salinity, and pressure are used as input parameters in machine learning models. Training historical data or simulation models can predict the speed of signals spreading under different underwater conditions, improving UWASN communication understanding and optimization.

## V. RESULT

In phase 1, 40 mobility nodes in clusters are designed in ns3, Using the LEACH protocol signal is transferred from the source. encryption is successfully implemented for secure signal transfer identifying the malicious nodes in the path of signal transfer. Output files such as XML file, tr file and CSV files are generated. The animation of the entire process is visualized by running the XML file in NetAnim. Thus signal is transferred successfully between the source and destination in a secure and energy efficient manner.

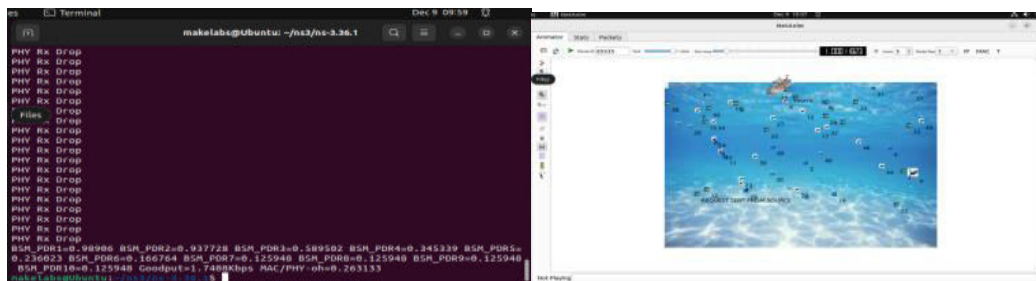


Fig no: 2 Run the underwater signal file in ubuntu and Source identified and request sent from source

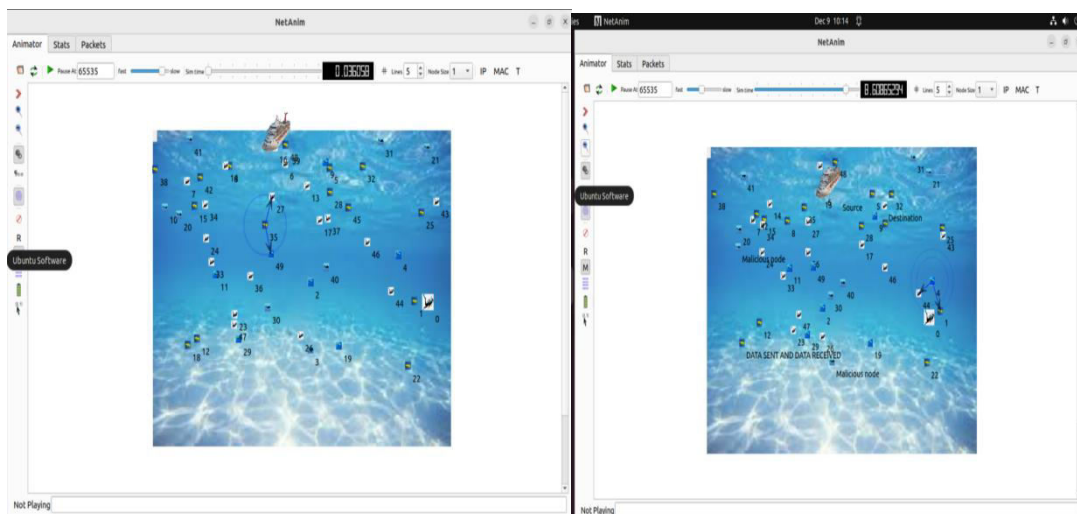


Fig no: 3 Start simulation and Data sent & data received, malicious nodes detected

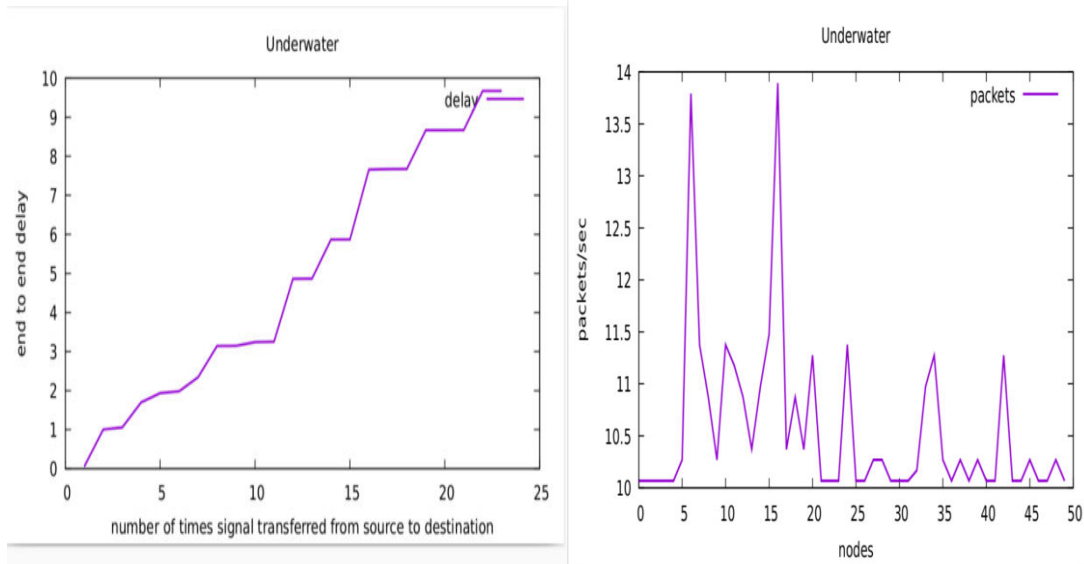


Fig no:4 Graph-end to end delay and Graph-energy consumption

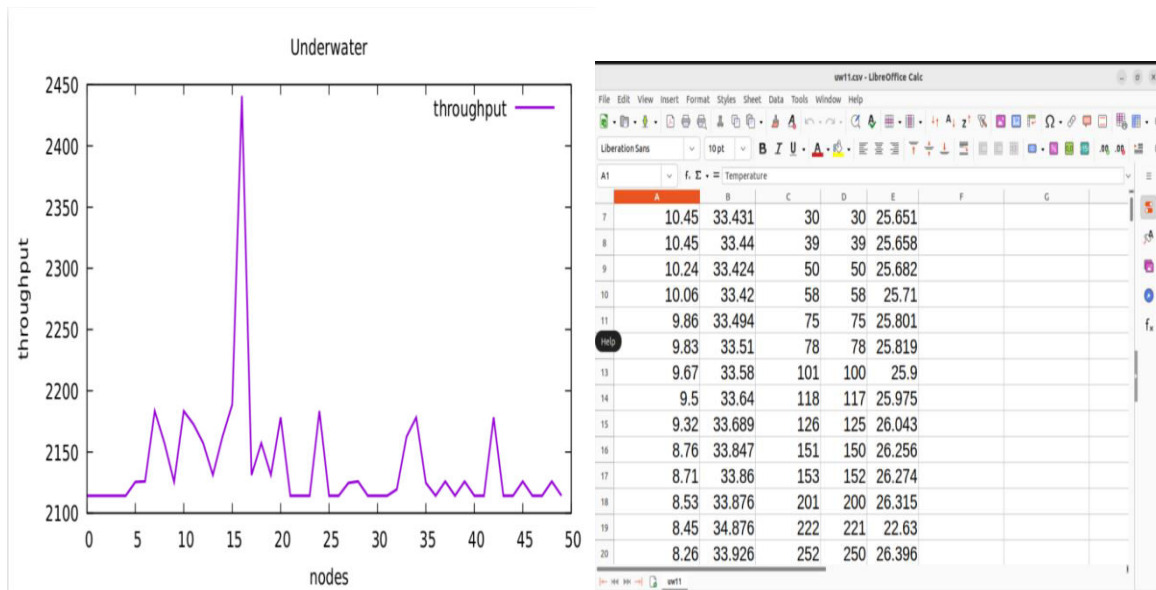
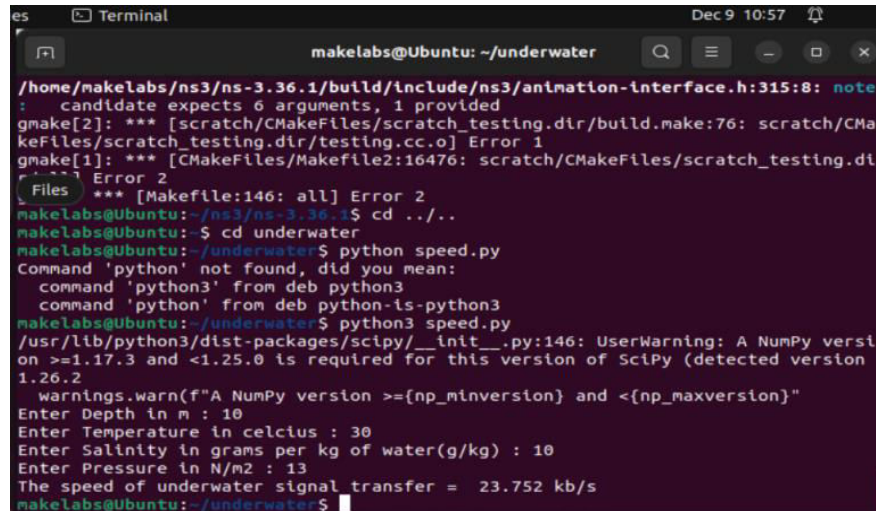


Fig no: 5 Graph-throughput & Csv dataset for deep learning



```

/home/makelabs/ns3/ns-3.36.1/build/include/ns3/animation-interface.h:315:8: note
: candidate expects 6 arguments, 1 provided
gmake[2]: *** [scratch/CMakeFiles/scratch_testing.dir/build.make:76: scratch/CMa
keFiles/scratch_testing.dir/testing.cc.o] Error 1
gmake[1]: *** [CMakeFiles/Makefile2:16476: scratch/CMakeFiles/scratch_testing.di
r] Error 2
Files *** [Makefile:146: all] Error 2
makelabs@Ubuntu: ~/ns3/ns-3.36.1$ cd ../../
makelabs@Ubuntu: $ cd underwater
makelabs@Ubuntu: ~/underwater$ python speed.py
Command 'python' not found, did you mean:
  command 'python3' from deb python3
  command 'python' from deb python-is-python3
makelabs@Ubuntu: ~/underwater$ python3 speed.py
/usr/lib/python3/dist-packages/scipy/_init_.py:146: UserWarning: A NumPy versi
on >=1.17.3 and <1.25.0 is required for this version of SciPy (detected version
1.26.2
warnings.warn(f"A NumPy version >={np_minversion} and <{np_maxversion}")
Enter Depth in m : 10
Enter Temperature in celcius : 30
Enter Salinity in grams per kg of water(g/kg) : 10
Enter Pressure in N/m2 : 13
The speed of underwater signal transfer = 23.752 kb/s
makelabs@Ubuntu: ~/underwater$

```

Fig no: 6 Predicting speed of underwater signal

## VI. CONCLUSION

The use of reach protocols in underwater acoustic sensor networks (UWASNS) has proven to be a significant advance in achieving efficient and secure signal transmitters. The implementation of cluster-based signaling, which is associated with the inclusion of malicious node identification and reduction, ensured both energy efficiency and robust security in data transmission. An in-depth analysis of power metrics including package tax ratios, average end-to-end latency, throughput, and energy consumption demonstrated the effectiveness of the laughing protocol in maintaining a high level of reliability and efficiency in underwater environments. Furthermore, the innovative integration of deep learning algorithms to predict the velocity of underwater signals based on environmental parameters provided a future-oriented solution for adapting to dynamic underwater conditions.

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