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Implementation Patterns of AquaSim for Simulation of Underwater Acoustic Wireless Sensor Networks

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ABSTRACT: Now days, a number of corporate as well as social applications are connected with wireless technologies which are covered under the domain of Internet of Things (IoT) and Cloud of Things (CoT). To work with the development and implementation of these scenarios, there is need of high performance costly gadgets which are difficult for the self finance researchers and small organizations. To cope up with the financial aspects of developing and getting the results from advanced wireless environment, the use of simulators and software libraries is done. In wireless environment, the segment of Underwater Wireless Sensor (UWSN) or Underwater Acoustic Network (UAN) is quite prominent which are used for the underwater applications including Military, Naval and Underwater Surveillance. Underwater sensor networks are famous for researchers and engineers in wireless technology. This field offers a lot of academic work in different disciplines. The main challenge of this UWSN is the energy saving for sensor nodes. For this cause, the location of sensor nodes shifts about regularly. There are several algorithms for energy production and collection, but this area is still in need of study due to political and national security concerns.

Keywords: Wireless Sensor Networks, Wireless Acoustic Networks, Underwater Sensor Networks

1. INTRODUCTION

Underwater acoustic based networking is problematic because of a number of factors. Numerous methods are found to boost up the longevity of aquatic networks. The idea is to develop technology for detecting the patterns of information communication so that the statistical analysis can be done on this future. Wireless Sensor refers to a collection of instruments with the potential to interact wirelessly with one another. It is used to quantify environmental parameters such as temperature, sound, humidity, wind, and so on [1, 2].

These networks have the same behaviors as cellular ad hoc networks. Wireless Sensor Networks are dispersed autonomous sensors that track physical or environmental environments and transfer data back to the central position. Today, these network linked sensors are used for both collecting information and producing information via the science sector [3, 4].

WSN is designed with the architecture of nodes consisting of from five to thousands of linked devices. Any such sensor nodes generally have many parts: a radio transceiver, a microcontroller, a circuit board, and an energy source, normally a battery or an embedded type of energy harvesting. Sensor network nodes may range in size from a shoebox to the size of a grain of dust, but having working micrometer sized "motes" of genuine microscopic measurements have yet to be created. The variable expense of the sensor nodes varies from a few to hundreds of dollars, depending on their size. The scale and expense of nodes would restrict what resources they will need. The network topology of the WSNs will range from a simplistic star network to a complex multi-hop wireless mesh network. The propagation form of the network may

be way or flood [5–7].

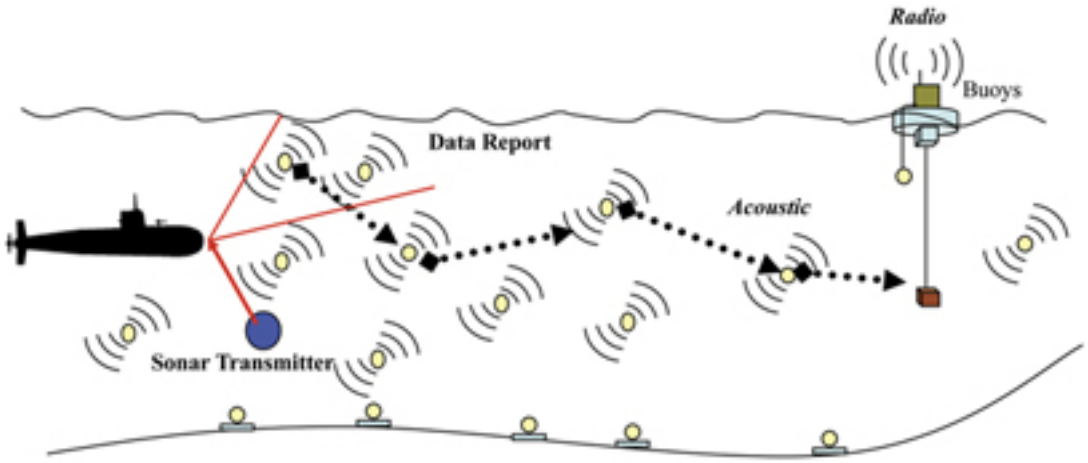

FIGURE 1. **Underwater Acoustic Wireless Network**

In computer science and telecommunications, wireless sensor networks are the active research field that coordinates several seminars and conferences. As of 2010, about 120 million wireless sensor networks have been built [8–10].

2. UNDERWATER SENSOR NETWORKS IN WIRELESS ENVIRONMENT

A number of wireless network simulators are available but the domain of Underwater Acoustic Network is still not having many options for the simulations and getting the predictive outcome [11, 12].

Following are the prominent Software Suites, Libraries and Simulators for Wireless Implementations for creating assorted network scenarios

Table 1. **Simulation Platforms and URL**

Simulation Library	URL
AquaSim	https://obinet.engr.uconn.edu/wiki/index.php?title=Aqua-Sim&redirect=no
OMNET++	https://omnetpp.org/
OPNET	http://opnetprojects.com/opnet-network-simulator/
ns2	https://www.isi.edu/nsnam/ns/
ns3	https://www.nsnam.org/
MATLAB	https://www.mathworks.com/products/matlab.html
GNS3	https://www.gns3.com/
Contiki Cooja	https://www.contiki-ng.org/
Cloonix	http://clownix.net/
IMUNES	http://imunes.net/
Kathara	https://www.kathara.org/

3. AQUASIM: THE SIMULATOR FOR UNDERWATER ACOUSTIC NETWORKS

Aqua-Sim is a simulating of underwater sensor networks. FASSS may be used to model acoustic signal attenuation, crashes and routing in underwater networks [13, 14].

These are the last instructions for setting the environment variables in.profile or.bashrc [15, 16]. This final performance indicates the efficient implementation of Aqua-Sim (or ns2.30 with Aqua-Sim extension) [17]

After implementing and operating the simulation, we would be able to simulate it using a proprietary software named Aqua3D [18, 19].

Recent technology advancements in acoustic modem technology aims to assure reliable communication between different remote instrumental. UWA networks are formed when the sensors, autonomous underwater vehicles, and surface

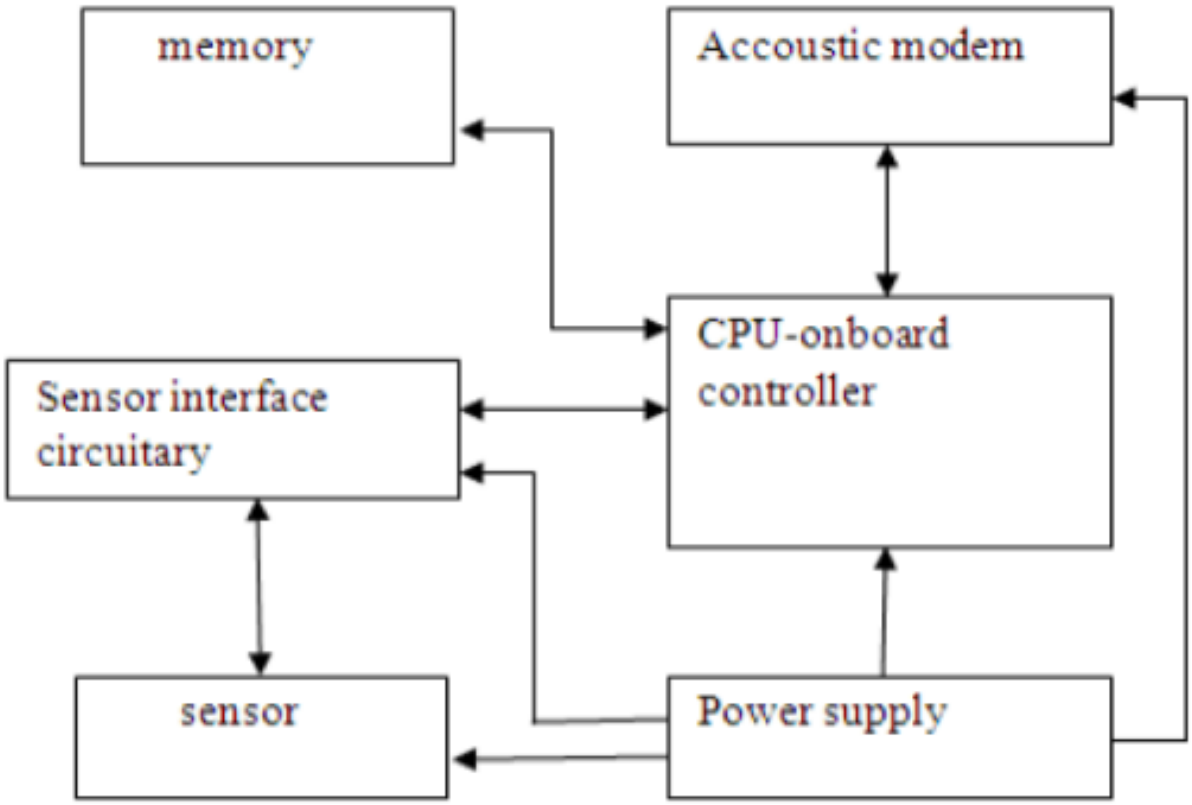

FIGURE 2. **Key Dimensions of Underwater Wireless Networks**

```
File  Edit  Tabs  Help
linkstate/ls.cc: In member function 'LsPaths* LsRouting::_computeRoutes()':
linkstate/ls.cc:877:46: warning: deprecated conversion from string constant to '
char*' [-Wwrite-strings]
     ls_error("computeRoutes: nhlp == NULL \n");
                                              ^
linkstate/ls.cc:914:44: warning: deprecated conversion from string constant to '
char*' [-Wwrite-strings]
     ls_error (" popShortestPath() failed\n");
                                            ^
In file included from linkstate/ls.cc:67:0:
linkstate/ls.h: In instantiation of 'void LsMap<Key, T>::eraseAll() [with Key =
int; T = LsIdSeq]':
linkstate/ls.cc:396:28:   required from here
linkstate/ls.h:137:25: error: 'erase' was not declared in this scope, and no dec
larations were found by argument-dependent lookup at the point of instantiation
[-fpermissive]
  void eraseAll() { erase(baseMap::begin(), baseMap::end()); }
                    ^
linkstate/ls.h:137:25: note: declarations in dependent base 'std::map<int, LsIdS
eq, std::less<int>, std::allocator<std::pair<const int, LsIdSeq> > >' are not fo
und by unqualified lookup
linkstate/ls.h:137:25: note: use 'this->erase' instead
Makefile:90: recipe for target 'linkstate/ls.o' failed
make: *** [linkstate/ls.o] Error 1
```

FIGURE 3. **Evaluation Patterns of Networks**

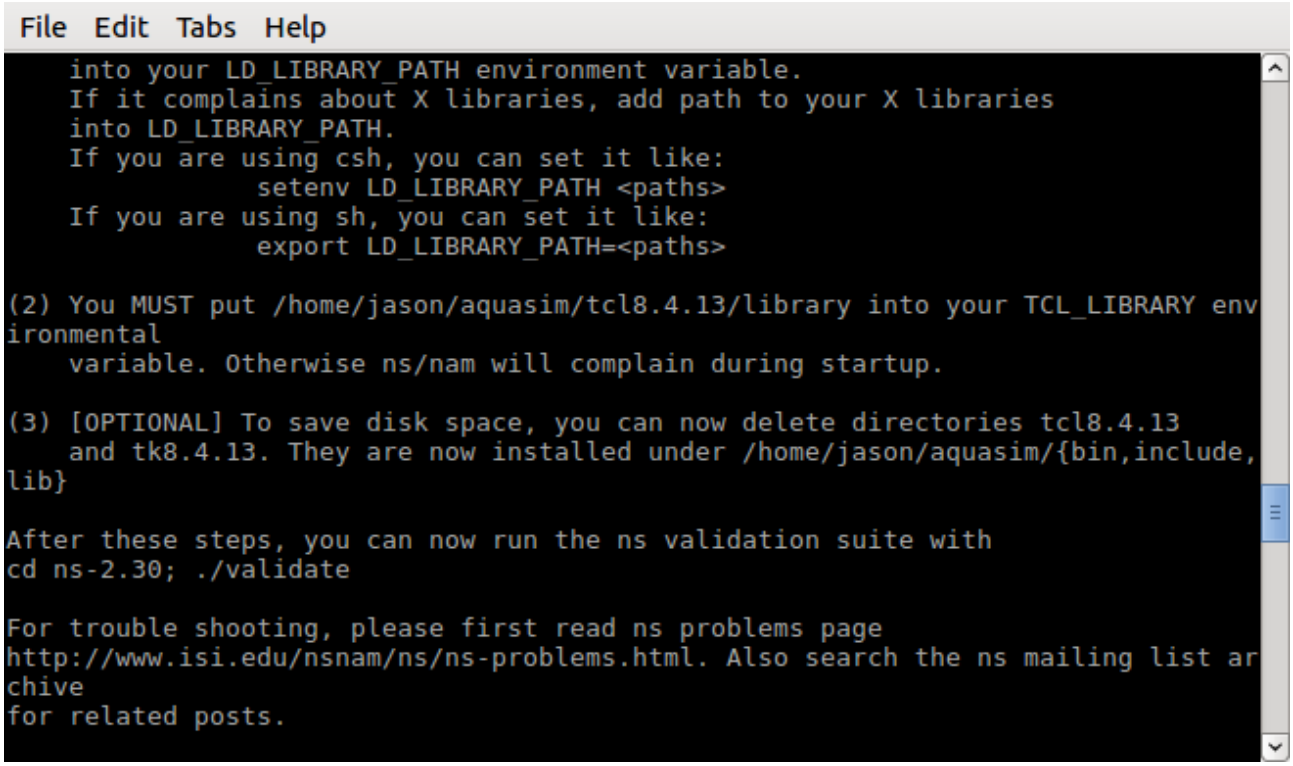

FIGURE 4. **Troubleshooting of Analytics**

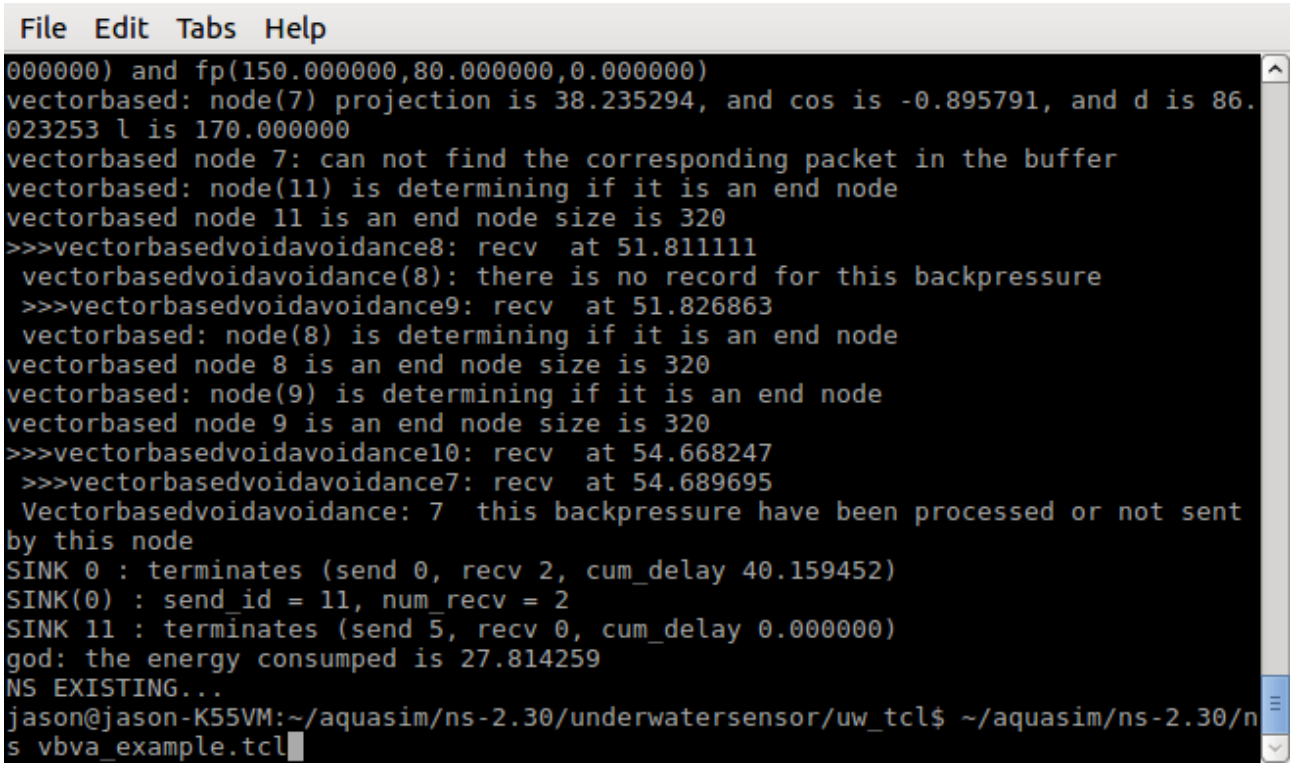

FIGURE 5. **AquaSim Analytics**

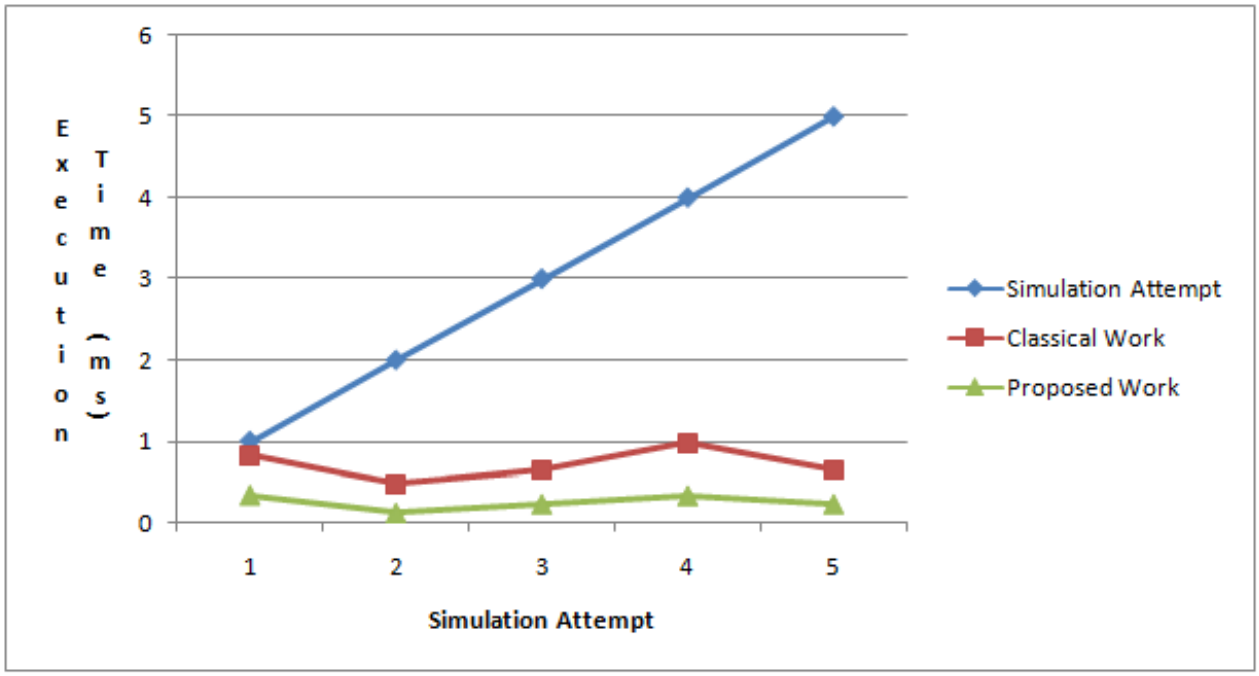

FIGURE 6. **Multi-Dimensional View of Wireless Network**

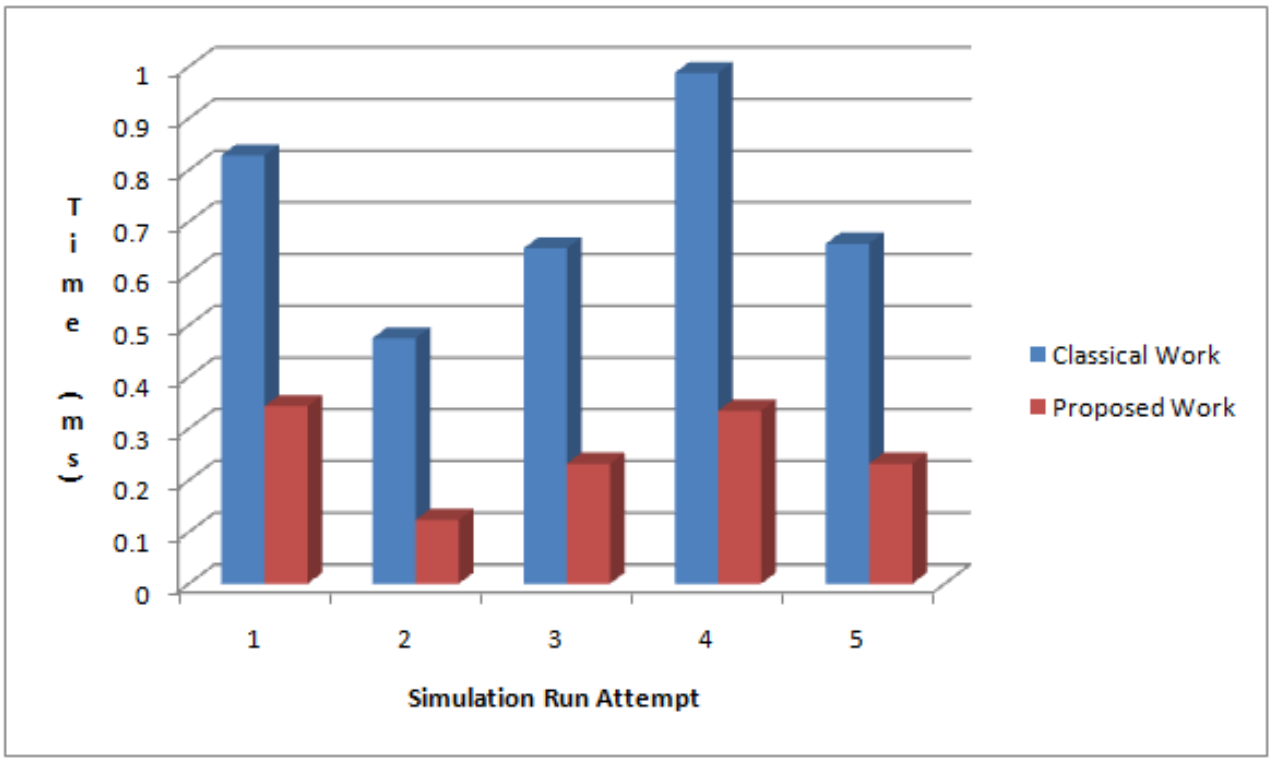

FIGURE 7. **Multi-Dimensional View of Wireless Network**

station are interconnected with one another. As the network will employ low-battery nodes, its lifetime will be limited. LUCC implement the shallow-water acoustic channel characteristics, such as low available bandwidth, highly varying multipath, and long propagation delays. Such an environment necessitates task of designing a UWA network that maximizes performance and reliability while minimizing power consumption.

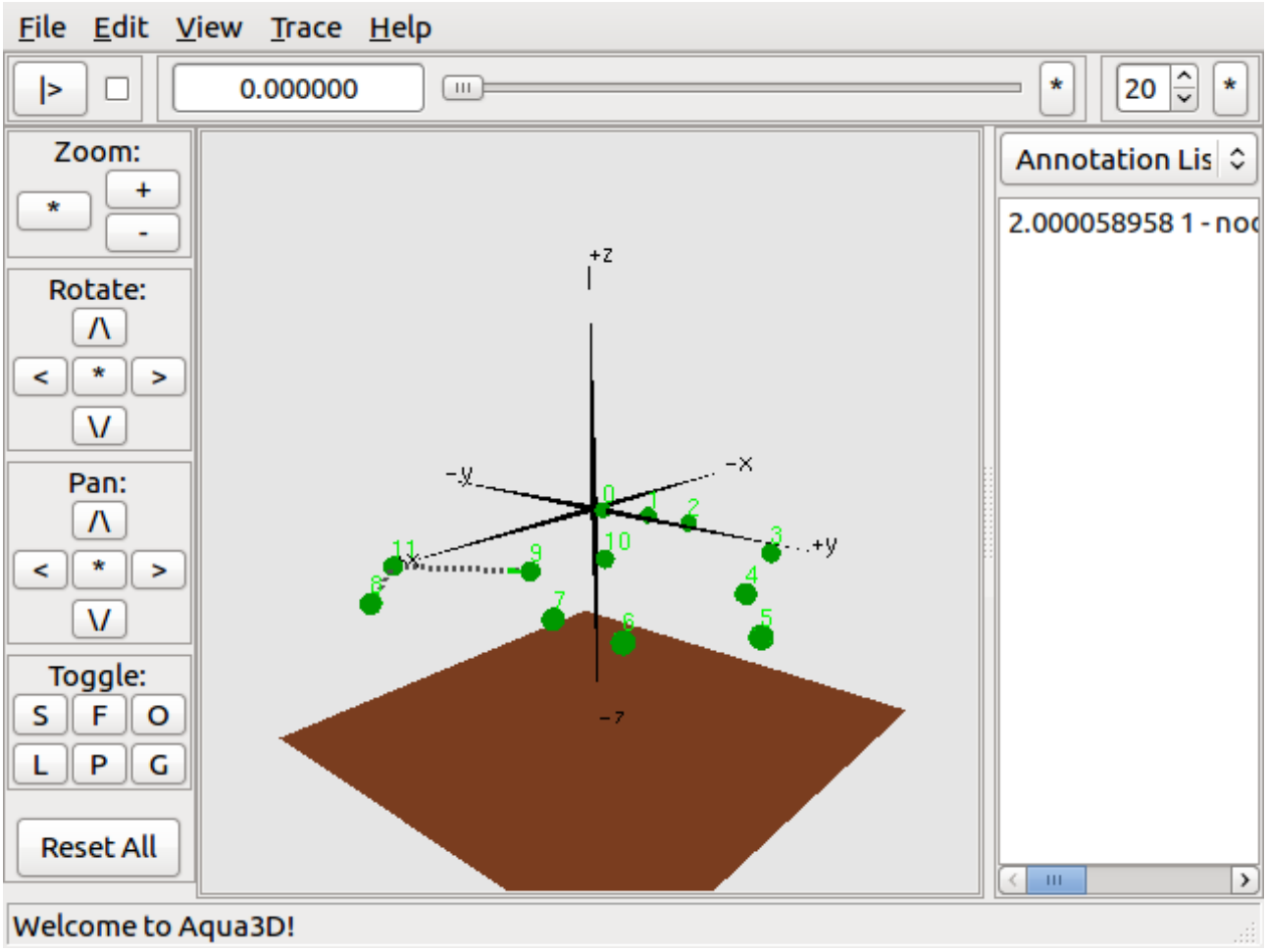

FIGURE 8. **Multi-Dimensional View of Wireless Network**

4. CONCLUSION

Wireless sensor networks are integrated network of sensors that capture various environmental parameters. Nodes are usually quick and independent with no centralized government. There are several limits to the WSN protection placed by limitations of computational power and resources of wireless networking. Privacy, protection, and availability may be attacked. Wireless sensor networks promote different capabilities and involve device architecture concepts that vary from traditional messaging paradigms. Due to the requirements of low system complexity and low energy usage, it becomes important to find the equilibrium between connectivity and signal/data processing capability. The R&D expenditures on block chain technologies have risen after last decade. Underwater cameras used for military purposes. The use of Unmanned or Autonomous Underwater Vehicles (UUVs) would allow the discovery of natural resources and collection of science data in joint monitoring missions. Underwater acoustic networking sets the basis for these applications. Underwater networks consist of a variable number of sensors and vehicles that conduct patrolling tasks over a specified area.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

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