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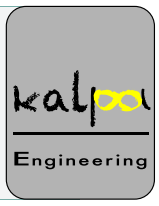

Security Challenges and Application for Underwater Wireless Sensor Network

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Abstract

The planet earth is covered with 70 to 75% of water and underwater much marine life is being living and surviving a life. Underwater Wireless sensor network has been also implemented under water from which many challenges occurs in transmission of the monitored data of under water hazards or can be said the disaster which is being to be occurs by the remotely access system and users of marine life as well as acoustic. In this paper, there is summarized key applications architecture and challenges in implementing the UWSN devices and an overview of this latest technology along with its research challenges and enhancing function.

Introduction:-

First of all it need to be justify the wireless technology by its real and specific definition, its functionality, working and the enhanced version of this technology by its different applications working in different fields. Therefore, in general it can be said that wireless sensor network is a network in which many sensors are attached in a network on the different locations and communicate wirelessly from different location. For example if it is talk about Air Pollution or any movement sensor it is situated at a place or can be said that established on a place and a user can gather all the data and information related to that sensing device through a network which is centralized.

There are two types of these wireless sensor network:-

1. Unstructured Wireless Sensor Network
2. Structured Wireless Sensor Network

In unstructured WSN nodes are densely collected and having Ad-hoc type of deployment and also it has difficulty in maintenance of the network In structured WSN the nodes are distributed scarcely and less deployed, deployment is preplanned and maintenance of the network is low. Now, what actually UWSN means. Is this technology is the enhanced term of wireless sensor network or it just different from that? As it is known that the planet earth is covered with 70% of water rest is covered with dense forests and land where life exists and underwater a huge amount of unexploited resources are lies under the water which can be used to be explore to the technology by the successful key skills to implement and execute them. These advance technology have driven the potential outcomes to do the submerged investigations utilizing sensors at all levels, which were impractical already. This technology is a combination of remote innovation with to a great degree little micromechanical sensor innovation having shrewd detecting, communication capabilities and intelligent computing. As needs be, UWSN is developing as an empowering innovation for underwater investigation. This is a

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network, which distributed its sensors nodes underwater to sense the properties related with the water such as its quality, temperature and its pressure.

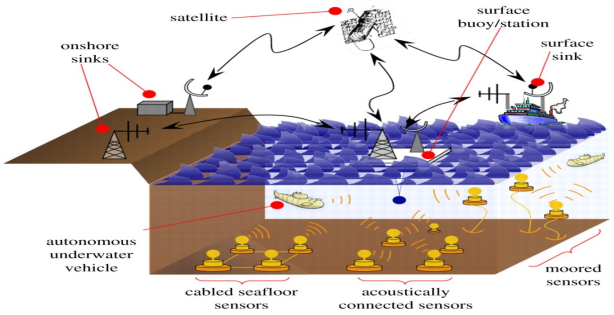

Figure1.1:- Underwater wireless sensor network.

In other words, UWSN is a system of self-ruling sensor hubs, which are spatially appropriated underwater to detect the problems and specially the problems. The detected information or can be said the data be used by assortment of utilizations that can be utilized for the advantage of people. The sensor hubs, stationary or portable, are associated remotely by means of correspondence modules to exchange different occasions of intrigue. Now when it comes to the data transmission, this technology is fundamentally finished with an arrangement of hubs transmitting their information to light door hubs transmitting their information to closest waterfront observing and control station likewise called remote station. Water waves are low recurrence waves, which offer little transmission capacity however have long wavelengths and waves can travel long separations and are utilized for transferring data over kilometers.

Security of underwater wireless sensor networks:-

Data which is transmitted on the channel is must be secure so by the qualities of this technology and its channel, UWSN are powerless against vindictive assaults. The current security arrangements proposed for WSN can't be utilized specifically in UWSN. In addition, a large portion of these arrangements are layer astute. We contemplated the danger, assault, and security issues of UWSN. Along these lines, we contend that layered security plans can't ensure UWSN against mixed assaults, a novel preparatory consider which is a cross-layer, versatile, particular security conspires.

Cost preference:-

As a part If it is talked about cost and all in UWSN, Cost of the hubs is one of the distinctions, as underwater wireless remote sensors are costly mostly on account of their more mind boggling handsets. Another distinction identifies with the sending costs. Arrangement of these sensors, particularly in profound waters, can be difficult and costly. Accordingly, a UWSN must be precisely contemplated and planed (as far as execution assessments, simulations, and tests) before its sending. Power is another essential distinction since underwater interchanges requires higher power than the earthly system. However, the most essential distinction is the correspondence medium. Underwater interchanges cannot utilize Radio Frequency (RF) signals. Since they have a gigantic constriction in the underwater medium. In this way, acoustic signs are utilized submerged

Architecture of Underwater wireless sensor network:-

After knowing all the basics and fundamental knowledge about UWSN, let us know some more layers of this technology by knowing a brief description about the architecture of UWSN in this section, which is a basic for the designing of the UWSN applications:

There are following architecture layers of UWSN:-

1. 1D-UWSN Architecture
2. 2D-UWSN Architecture
3. 3D-UWSN Architecture
4. 4D-UWSN Architecture

1. 1D-USWN Architecture:-

One-dimensional-(1D-) UWSN design alludes to a system where the sensor hubs are conveyed self-governing. Every sensor hub is a remain solitary system itself, in charge of detecting, preparing, and transmitting the data to the remote station. A hub in this kind of engineering can be a skimming float, which can detect submerged properties, or it can be conveyed submerged for a specific period to detect data and after that buoy towards the surface to transmit the detected data to the remote station. It can be a self-ruling submerged vehicle (AUV) which jumps inside the water, sense or gather the submerged properties, and hand-off the data to the remote station. In 1D-UWSN the hubs can convey utilizing acoustic, Radio Frequency (RF), or optical correspondence. In addition, the topological idea of 1D-UWSN is star where the transmission over the sensor hub and the remote station is continued a solitary jump.

2. **2D-UWSN Architecture: - Two**-dimensional-(2D-) UWSN design alludes to a system where a gathering of sensor hubs (bunch) is conveyed submerged. Each group has a bunch head (additionally called stay hub). The bunches are settled as they are tied down at the underwater surface. Every individual from the bunch accumulates the underwater information and conveys it to the grapple hub. The stay hub assembles the data/information from all its part hubs and transfers it to the surface light hubs. In 2D-UWSN, the correspondence is conveyed in two measurements; that is, every individual from the bunch speaks with its grapple hub with level correspondence interface while, the stay hub speaks with the surface light hub with vertical correspondence connect. In 2D-UWSN, acoustic, optical, and RF correspondence can be utilized relying upon the kind of utilization and nature of underwater condition. In 2D-UWSN, acoustics correspondence is favored for underwater grapple hub and the surface light hub because of ordinarily high separation between them. For the bunch of hubs, the system game plan can be star, work, or ring contingent upon the application necessity. The 2D-UWSN can be utilized for both time-basic and defer tolerant applications.

3. **3D-UWSN Architecture: -** In this sort of system, the sensors are conveyed underwater as bunches and are tied down at various profundities. Because of the organization of the sensors at variable statures, the correspondence between the sensors goes past the two measurements.

There are three correspondence situations in this engineering:

(I) intercluster correspondence of hubs at various profundities.

(ii) Intracluster (sensor-stay hub) correspondence.

(iii) Grapple light hub correspondence. In each of the three sorts of correspondence situations, acoustic, optical, and RF connections can be utilized.

4. **4D-UWSN Architecture:-** Four-dimensional-(4D-) UWSN is composed by the blend of settled UWSN, that is, 3D-UWSN and portable UWSNs. The versatile UWSN comprises of remotely agent underwater vehicles (ROVs) to gather information from the stay hubs and hand-off the information to the remote station. ROVs can be self-sufficient submersible robots, vehicles, sends, and even submarines. Each underwater sensor hub can be self-ruling in handing-off the information specifically to ROVs contingent upon how shut that specific

sensor hub is to the ROV. The correspondence situation between ROV and submerged sensor hub relies upon the separation and information amongst them and either acoustic or radio can be utilized. As the transmission is to be specifically transferred to ROV, the sensors, which have substantial information and are near ROVs can utilize radio connections while the sensors which have little information to transmit or are a long way from ROV can utilize acoustics joins.

Applications of Underwater wireless Sensor Networks:-

The need to detect the underwater world drives the improvement of underwater sensor systems. Applications can have altogether different prerequisites: fixed or portable, short or enduring, best exertion or crucial; these necessities can result in different designs.

1. **Environmental Monitoring:-**
    1. It monitors soil water and mineral content for irrigation, soil conditions for sports field monitoring, soli movement for landslides prediction.
    2. It also monitors coalmine, glacier movement and earthquake monitoring.
    3. It is also deployed for monitoring a golf course by monitoring soli salinity, water content and temperature
2. **Infrastructure Monitoring:-**
    1. In infrastructure monitoring the sensors monitors the infrastructure of the pipe, wiring and underground components like dams and the minefields.
    2. In this application, the sensors also deploy for the location determination of objects, which includes driver alert, autonomous fertilizer unit, and in case of building collapse it locate people.
3. **Border petrol and security monitoring:-**

    It monitors the home security system and detects the border intrusions.
4. **Seismic Monitoring:-**
    1. In this application on underwater wireless sensors network helps in monitoring for oil extraction from underwater field.
    2. Its survey can only be carried out rarely and its cost is high.
5. **Underwater Discovery:-**
    1. Underground remote sensor systems can be utilized to discover oilfields or stores find courses for putting associations for intercontinental submarine links.
    2. Additionally they could look for wrecks or antiquarianism or lost sink urban communities.

Application Deployment:

Portability and thickness are two parameters that shift over various sorts of organizations of submerged sensor systems. Here, we concentrate on remote submerged systems, in spite of the fact that there is significant work in cabled submerged observatories, from the sound reconnaissance framework military systems in the 1950s, to the current Ocean Observatories Initiative. Submerged systems are regularly static: singular hubs appended to docks, to secured floats or to the sea surface. On the other hand, semi-portable submerged systems can be suspended from floats that are conveyed by a ship and utilized incidentally, yet then left set up for a considerable length of time or days. The topologies of these systems are static for long lengths, enabling building of the system topology to

advance network. Be that as it may, organize network still may change attributable to little scale development (as a float processes on its grapple) or to water progression (as streams, surface waves or different impacts change). At the point when battery controlled, static organizations might be vitality obliged. Submerged systems may likewise be portable, with sensors appended to AUVs, low-control lightweight planes or unpowered wanderers. Versatility is helpful to augment sensor scope with restricted equipment, however it raises challenges for confinement and keeping up an associated organize. Vitality for correspondences is copious in AUVs, yet it is a worry for lightweight planes or vagabonds. Likewise with surface sensor systems, arrange thickness, scope and number of hubs is interrelated parameters that portray an organization. Submerged arrangements to date are for the most part less thick, have longer range and utilize significantly less hubs than earthbound sensor systems. For instance, the Sea web arrangement in 2000 included 17 hubs spread over a 16km2 zone, with a middle of five neighbors for each hub. Finally, as with remote earthbound systems, network to the Internet is critical and can be difficult.

Challenges of Underwater wireless sensor networks:

With the headways of acoustic modem innovation that backings better information rates with dependable correspondences, ebb and flow explore concentrates on calculations those can bolster such innovation bestly. Amid the most recent two decades, numerous conventions proposed to deal with the antagonistic condition of submerged correspondences. This proceeded with investigate brings about enhanced execution as contrast with starting correspondence frameworks. Yet at the same time submerged issues like restricted data transfer capacity, high engendering postponements and 3-D topology and additionally control requirements of the sensor hubs are challenges for the effective routings.

Challenges in research field:-

1. Extraction of data, reliably, localization, where each node to determines its location when it is deployed or should it move.
2. Distributed clock synchronization clocks for accurate data reporting.
3. Localization algorithms are based on the signal strength or the time- of-arrival (TOA). TOA-based algorithms estimate distances between nodes by measuring the propagation time of a signal.
4. Energy management approaches to extend sensor network lifetime for a multiyear deployment
5. Acoustic networks have very limited communications bandwidth. How to coordinate node's transmissions in an energy-efficient way that can best utilize the channel? Acoustic radio at 20kb/s⎫ raw transfer time for one⎫ node is 16 minutes.

Other challenges in UWSN:-

Power Conservation, Topology Design, Antenna Design, Environmental Extremes.

1. Power Conservation: - As the name itself describes underwater sensor means at underground sensor nodes require more power as attenuation is more. As it is undergrounded so charging batteries or replacing them become a difficult task. In underground, we are not even able to use any other energy resources like solar energy or any alternate energy. Therefore, it is very necessary to conserve the power under the water. It is necessary that it can be implemented by using power efficient hardware and communication protocols.

2. Topology Design:-

- Considerations:-The density of sensor deployment is dictated by the application. Security application require dense whereas soil monitoring less dense deployment › Power usage minimization-Power usage can be minimized by designing a topology with a large number of

short-distance hops rather than a smaller number of long-distance hops. › Cost-Deeper and Denser deployments result in more costs. Establish tradeoffs.

- Underground topology:-All sensor devices underground, Sink may be underground or above it, Can be single depth or multi depth, Provides maximum concealment of network and Ground air ground path can be used.

3. Antenna Design:-

Issues to be considered: - Variable requirements-Devices near the surface air interface have different requirements from those deeper inside as they suffer from reflection.

Size:-Lower frequencies require larger antennas; this is a challenge as sensor device size should be small. Directionality:-The antennas should be oriented for both horizontal and vertical communication.

4. Environmental Extremes:-Underground environment is not ideal for electronic devices. Protection from water, animals, insects etc. is needed. Devices should be resistant to pressure of people or objects moving overhead

CONCLUSION AND PROPOSAL FOR THE FUTURE CONCERN:

UWSN is a promising new field and may help in investigating the unfathomed world those untruths underwater, there are many challenges and opportunities as well. We have displayed an extensive writing audit of UWSN applications and the challenges grouped in term of research and general term challenges. It was watched that a decent number of utilization are helped by UWSNs for the brutal underwater condition. UWSN has turned out to be one of the prime concentrations for analysts. On the off chance that these applications are appropriately misused, a great deal of lives, time, and cash can be spared. In spite of the fact that UWSNs have seen an enormous measure of development in the previous couple of years, there is yet a space for sufficient commitments especially in the physical arrangements of the frameworks on huge scale. and if it is talked about the future work one idea knock our mind sometimes "Radio waves are extremely strongly attenuated in salt water" so if a sensor device is waterproof then why should it not will proof from salty water so that the waves will be strong in communication n connection of transmission of data should not be interrupt.

References:-

[1] Domingo M. C., Prior R.Energy analysis of routing protocols for underwater wireless sensor networksComputer Communications20083161227123810.1016/j.comcom.2007.11.0052-s2.0-40949083548.

[2] Menon K., Divya P., Ramesh M.Wireless sensor network for river water quality monitoring in IndiaProceedings of the 3rd International Conference on Computing Communication Networking Technologies (ICCCNT '12)July 201217.

[3] Açar G., Adams A. E.ACMENet: an underwater acoustic sensor network protocol for real-time environmental monitoring in coastal areasIEE Proceedings: Radar, Sonar and Navigation2006153436538010.1049/ip-rsn:200450602-s2.0-33746374275.

[4] Zhang S., Yu J., Zhang A., Yang L., Shu Y.Marine vehicle sensor network architecture and protocol designs for ocean observationSensors201212137339010.3390/s1201003732-s2.0-84863048562.

[5] Nasser N., Zaman A. N. K., Karim L., Khan N.CPWS: an efficient routing protocol for RGB sensor-based fish pond monitoring systemProceedings of the IEEE 8th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob '12)October 201271110.1109/wimob.2012.63791682-s2.0-84872058085.

[6] Tyan S., Oh S.-H.AUV-RM: underwater sensor network scheme for AUV based river monitoringResearch Trend in Computer and Applications, SERCE2013245355.

[7] Khan A., Jenkins L.Undersea wireless sensor network for ocean pollution preventionProceedings of the 3rd International Conference on Communication Systems Software and Middleware and Workshops (COMSWARE '08)January 20082810.1109/comswa.2008.45543692-s2.0-51849104106.