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Tsunami Detection and forewarning system using Wireless Sensor Network - A Survey

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***Abstract*-**The Tsunami is a natural disaster which can occur over a rapid period of time. The timely report and the responses are very much important to reduce the losses. Certain methods are being followed to detect and inform the public. One of the reliable methods is the WSN. The wireless node sense the vibration of the earth crust, the changes noted will be given to the controller. The controller sends the information to the base station through the radio waves. The wireless sensor devices are equipped with the microcontroller, a small RAM for data storage, a flash memory to hold the program, Wireless transceiver, antennae, ADC Converter, and a power source. Our objective is to study the different sensor network protocols to resolve the issue, thus to identify the energy competent wireless sensor network for the considerable improvement in the tsunami disaster management.We also analyze the WSN protocol based on metrics such as Energy competence, location awareness, and network lifetime.

***Keywords*-**Disaster Management, Sensors, Energy efficiency, WSN

1. INTRODUCTION

The tsunami forewarning system is an immense task. It is important about proper management to optimize efficiency of planning and response. It is an event of natural causes that lead to sudden disruption of normalcy within society, causing damage to life and property, to reduce this damage effective management of information is important in the forecasting.

2. SENSOR NETWORK FOR TSUNAMI FORECASTING

In WSN there should be an operating system to perform the task concurrently and a protocol stack for communication, a network services for fruitful communication. The vibration sensor can be attached to the sensor node. The battery is the main power source for the sensor node, since the nodes are monitoring continuously the power dissipation will be more for that the structure of the node implementation has to be taken in to the consideration. In this we are going to implement the unstructured WSN. The nodes are deployed in the adhoc manner. We have to deploy the unstructured network for seismic sensing to have a continuous monitoring.

3. WIRELESS SENSOR NETWORK FOR LANDSLIDE DETECTION

Maneesha V et al. proposing their research in wireless sensor network for landslide detection. This paper report on the implementation and deployment of a system for rainfall induced landslide detection system using wireless sensor network at Anthoniar Colony, Munnar, Idukki(District), Kerala (State),India and analyze the positive outcome and achieved it. Here they implemented a data acquisition boards to connect the external sensors to the wireless sensor nodes. Due to the inefficiency of the commercial sensor they have positioned a sensor column design[Fig. 1] with all geological sensors connected to the wireless sensor nodes. The result of this paper shows the efficient deliverance of the real time data to the data management center by using a heterogeneous network composed of wireless sensor nodes, Wi-Fi , and satellite terminals.[1]

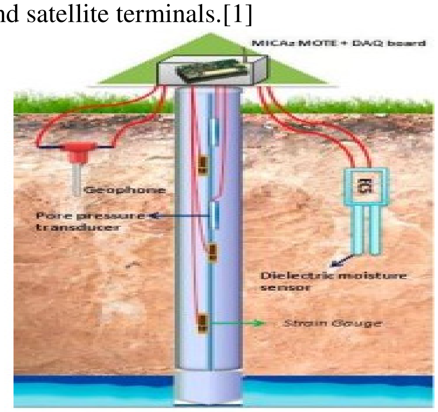

Fig.1: Sensor column Design

4. SENSOR NETWORK ARCHITECTURE FOR TSUNAMI DETECTION AND RESPONSE

Kanan Casey (2008) et al. described their research in sense and response system for tsunami detection and mitigation

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using the directed diffusion routing protocol as a network protocol and developed a several communication mechanisms to improve its performance.

The proposed approach, which uses the three types of sensor station and nodes: sensor, commander and barrier. The sensor nodes simply sense and report pressure data to commander nodes.The commander nodes analyze the data and send command messages to barrier nodes. The goal of the directed diffusion is to perform multipoint-to multipoint communication using named data. The localization plays a major role, here the route repair mechanism for directed diffusion which emphasizes localization. It proves that the system would be justified for the limited usage.[2]

5. WSN FOR UNDERWATER NETWORKS

Vijay Chandrasekhar et.al.Analyzed their research in the location of every sensor and the process of estimating the location of each node in sensor network is known as localization.

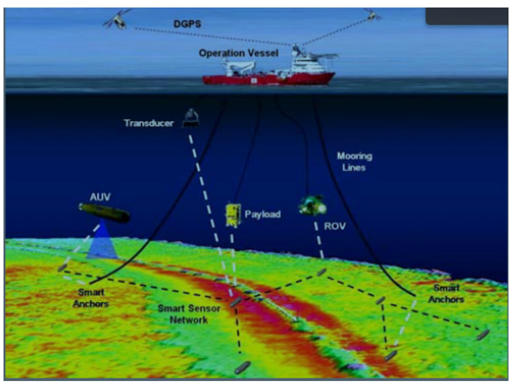

Fig.2.An example application scenario for underwater sensor networks

This Fig.2 system shows the sensors, anchors, and ROVs/AUVs collect information from the seabed and feed the data to the vessel. The sensors and anchors can measure parameters like foundation strength and mooring tensions, and ideally provide accurate position references to the AUVs whilethey survey the deep sea environment with sophisticated surveillance equipment. A mechanism for data delivery from the seabed to the ship is required. In such a system, the location of the sensors, anchors and the AUVs need to be determined. The localization problem is especially challenging for deep water applications. The problem of localization in under water sensor network has a challenges due to the acoustic transmission medium.The localization discussed in this shown to work in simulation and the performance needs to be evaluated.[3]

MelikeErol-Kantarci, et.al .proposed the research on localization, state-of-the- art oceanographic systems , and the challenges of under water communications.The discussion is about the various methods to provide location informationfor the anchors. Anchors can be located at fixed locationsand their coordinates may have been pre-configured, or theymay have special hardware to learn their locations from alocation server, such as the Global Positioning System (GPS). The two methods called angulation and lateration were used. Angulation utilizes the bearing information and thegeometric principles of triangles, whereas lateration uses thedistance between two nodes, i.e. the range, and intersectingcircles. Lateration is a widely used technique which is alsoemployed by the GPS system.

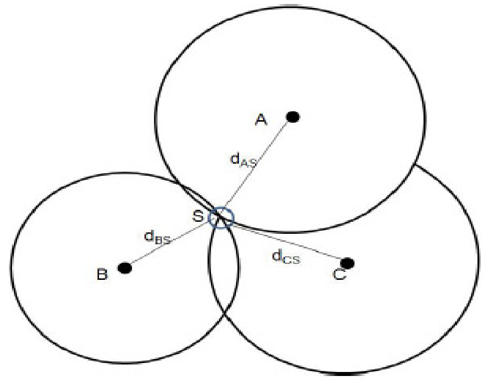

Fig.3.Lateration Method

Here, thelocation of a node is determined by computing the intersectionof three circles. Multi-lateration is a generalization of theclassical trilateration where n coordinates can be estimatedby $n + 1$ non-coplanar anchor coordinates. For instance, toestimate the coordinates of a node, denoted by (x, y, z), onecan use the set of equations:

$(x - x_i)^2 + (y - y_i)^2 + (z - z_i)^2 = d_i^2 \quad (1)$

where(x_i, y_i, z_i) are the coordinates of the anchor and d_i is themeasured distance between the anchor i and the node. Notethat, underwater nodes are usually able to attain their depthby their pressure sensors, hence in UASN research generallythe localization problem is simplified to estimating the (x, y)coordinates.They have also discussed about the underwater sensor positioning and prediction schemes.[4]

6. WIRELESS SENSOR NETWORK FOR TSUNAMI DETECTION

HarminderKaur, et.al.Analyzed the basic architecture of WSN that can helpful in disaster management and the wireless sensor network model that can be employed for different sensor network solutions.They discussed about the tsunami happened in 2004 in Bay of Bengal, the complete east coast of India. It is estimated that tens of thousands of people died in that event only in India and lakhs in other countries of Asia. Even recently, almost 32 countries throughout the world were put on alert, when an earthquake of 8.9 measure on Richter Scale struck in Indian Ocean. Thanks to the effective monitoring system, an alert was sounded and more coastal areas were evacuated. Though Tsunami is not a common sight in India when compared with Japan, Indonesia, Vietnam and Thailand, yet it is wiser to be alert rather than repenting after the tragedy. A system for tsunami detection and mitigation using a wireless ad hoc sensor network defines three types of nodes: *sensor*, *commander*, and *barrier*. The same which was followed by Kanan Casey[2].A relatively largenumber of sensor nodes collect underwater pressure readings across a coastal area. This data is reported to commander nodes which analyses the pressure data and predict which, if any, barriers need to fire. Although it is impossible to completely stop a tsunami, we propose using a number of barriers which may be engaged to lessen the impact of the wave. Fig.4 illustrates the architecture of a prototype system that can be implemented as live-model up to a level of perfection and satisfaction. Fig.4 depicts a sensor network consisting of 80 underwater sensors (Sensor1-Sensor80) that are connected to two commander nodes which are in turn connected to four barriers (Barrier1-Barrier4). An algorithm as suggested by K. Casey, A. Lim, and G. Dozier et.al. has been implemented [10] which uses a general regression neural network (GRNN) [11] as prescribed by D. Specht, to predict the path of the wave.

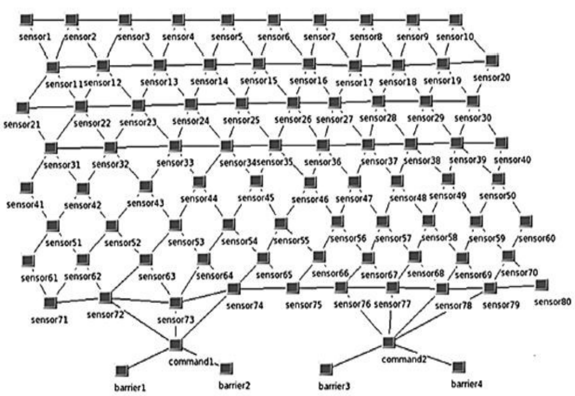

Fig.4 Tsunami Detection and Response System Architecture

The GRNN analyzes the pressure data from sensor nodes and predicts which barriers should fire to most effectively impede the tsunami. It also uses a real-time response mechanism for diffusion. This protocol is inspired by RAP [7] predicted by C. Lu, B. Blum, T. Abdelzaher, J. Stankovic, and T. He but does not require location information.As a result of research, the implication of wireless sensor network in various disaster prediction and mitigation was discussed.

7. WSN FOR EARTHQUAKEDETECTION

Rui tan (2010) et al. To describe their current Earthquake Detection using WSN, they described novel qualities driven approach to achieve real time, prolonged volcanic detection. Theseapproaches were based on 'collaborative signal processing algorithm'. The outcome of this is minimizing sensor's Energyconsumption subject to sense quality requirement [8].

Makoto Suzuki (2007) et al. proposed an earthquake monitoring system. For high accuracyin results, they developed an OS, which is hard real time operating system for sensor nodes, and accelerate the sensor board. In this model work in wireless mode and acceleration sensor board is necessary for earthquake monitoring. As a result, they have easily identify the evaluation of high precision earth quake and high density earthquake monitoring system [9].

Naveed Ahmad (2011) et al, analyzed architecture for adhocWSN for Disaster Survivor Detection as shown in figure-5 .These Wireless Ad hoc sensor nodes are playing an important role in wireless data transmission infrastructure. The proposed model for this detection isbased on extremely dangerous disaster situations where this Architecture can successfully trace and locate thousands of people in serious circumstances. The emphasis of this paper focuses on earthquake based disasters. [10].

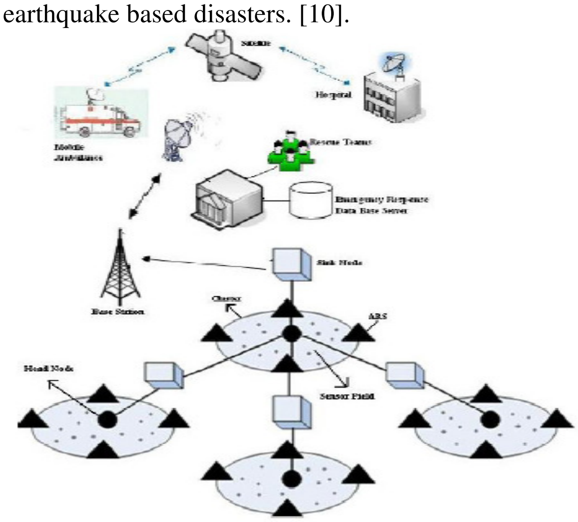

Fig.5: Adhoc Wireless Sensor Network

8. CONCLUSION

This review on wireless sensor network gives the information, how efficient the protocols are useful in identifying the disasters in rapid speed and the performance was noted based on the efficiency. The Localization is the huge task in the tsunami prediction system.

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