International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 4 (2015) pp. 10841-10848

http://www.ripublication.com

A Proposal for Seismic Monitor Using Deep Sea Internetwork

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Abstract

Communication networking while travelling by sea or larger water bodies is a challenge to communication industry. Implementation of wireless networks inside larger water bodies is undergoing projects in many countries. Here in this paper underwater networking for internet purpose and other speedy communication has been taken as a major issue used for seismic monitoring. This paper proposes networking architecture to provide efficient interoperability with traditional TCP/IP protocol stacks for commercial underwater modems and also it could deliver more reliable warning in real-time. Many number of SM-75 modems are placed in the sea floor. SM-75modem is a float, release all in one .It contains electronics (Connector board, the DSP board, the Transmitter board, and the Band pass board), batteries, transducers, and housed with a burnt wire release system. It can operate independently.SM-75 modem communicates with the universal deck box (UDB-9400) and modem that is placed in the surface, wirelessly. UDB-9400operates on acoustic releases communicate and control acoustic modems. It consists of battery, RS232 port for direct connection to laptop/pc (Linux driver).From the data we can predict that the earthquake is going to occur. By providing this information in real-time via, laptop, Smartphone, tab could save lives.

Keywords: underwater wireless communication, protocol stack, smart modems, seismic monitoring

Introduction

Underwater monitoring missions can be extremely expensive due to the high cost involved in underwater devices. There includes many different types architectures for Underwater Acoustic Sensor Networks, depending on the application. Some are as follows Two-dimensional under water acoustic sensor networks for ocean bottom monitoring. Three-dimensional under water acoustic sensor networks for ocean column monitoring. Land based wireless networks rely on radio waves that transmit data via satellites and antennae. Radio waves works poorly on underwater so it relies on sound waves. Acoustic communication is a technique of sending and receiving message below water. Because of limited interoperability with Existing networks that is based on the transmission Control Protocol/Internet Protocol (TCP/IP) architecture underwater devices cannot be regarded as the traditional networking realm. A similar situation was also experienced by wireless sensor networks, until Low power Wireless Personal Area Networks (6LoWPAN) became part of the Internet suite of standardized Protocols. It is essential to design and test a standardized protocol stack that can efficiently provide interoperability for underwater networking devices [1].Existing protocols solve some of the aforementioned challenges through ad-hoc design. Most of them regard the underwater acoustic network as a system isolated from the Internet. Existing protocols uses Proprietary addressing schemes. The traditional devices that cannot access underwater nodes with exiting tools i.e., based on transmission Control Protocol/Internet Protocol (TCP/IP) protocols.

To address these problems, Hui et al. [3] proposed the Low power Wireless Personal Area Networks (6LoWPAN) architecture for wireless sensor network, which provides an IPv6 protocol stack for resource-constrained devices.6LoWPAN provides a solution for header compression, data fragmentation and auto-configuration.

The high propagation delay of underwater networks and the channel characteristics require optimized, channel-dependent frame size to increase channel utilization and energy efficiency [4,5].

SEAWEB [6] is an existing experimental deployment of underwater networks. It defines its physical, link and network layers of underwater network. However, interoperability is significantly limited and the system uses a specialized repertoire of communication gateways. SEAWEB requires human intervention to setup and monitor the system at the gateway.

Network model for underwater acoustic sensor networks is compatible with the traditional TCP/IP protocol and it supports both IPv6 and IPv4 (Internet Protocol Version 4and 6). The software architecture that cooperates with existing operating systems and can be easily reconfigured to cooperate with different underwater modems. The architecture is optimized for underwater networks by introducing header compression, data fragmentation and router proxy.

Related Work

In the past ten years many number of protocols have been proposed in that they have concentrated only on data link or network layer without considering the whole protocol stack. There are three types of models that interface and make the underwater network remotely accessible from the internet (as telemetry).

A. System Model

In this we considered underwater networks compose border routers and underwater nodes. There are many border routers so that each of the nodes is able to find their apt border router. It leads to minimal energy consumption. Border router operates at the network layer and bridge the underwater network sensor network segment with the traditional IP-based network. Underwater nodes may be naturally divided into subsets on different physical layer protocols.

B. Network Model

In this the system follows the traditional TCP/IP five layer model. The objective is to design the network model compatible with different physical and data link layer protocols. The adaptation layer is inserted to interface the traditional IP network Layer .Mesh routing is also performed at this layer. This network is designed in order to maintain the protocol stack.

C. Software Model

Linux driver is implemented in this software architecture we benefit from the robustness of Linux networking core without modifying TCP/IP transport and network layers. Driver works on adaptation layer and its two parts. One is the kernel mode responsible for device-independent functions. And the other driver component runs in user mode so that it is easily reconfigured to communicate with devices from different vendors.

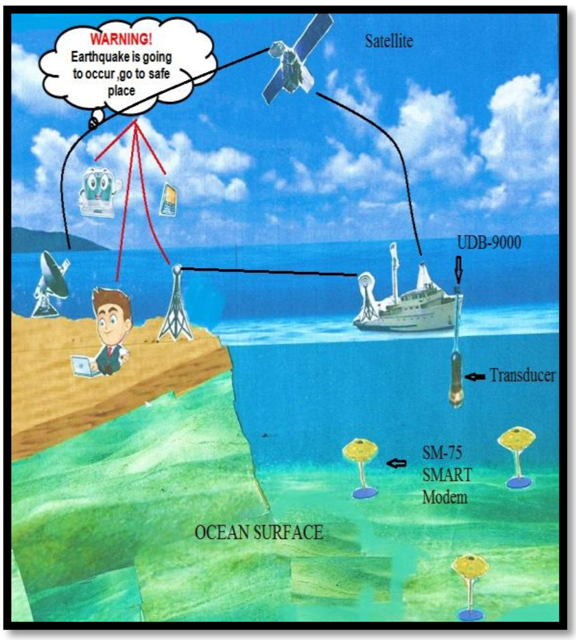

Figure 1: Early Warning from Deep Sea

Modems and Earthquake Monitoring Systems

There are many types of modems that are used for acoustic communications .In this project we have used Benthos SM-75 Smart Modem Acoustic Release Technology (SMART) Modem. We are going for this SM-75 Modem because everything is built in a single modem such as sensors, electronics, batteries etc., this can transmit the data in real time with the combination of universal deck box (UDB-9000).Many types of sensors are available for measuring Earthquake/Tsunami .But in SM-75 Modem sensors are inbuilt so no need of using a separate pressure sensors.

A. SM-75 SMART Modem

The SM-75 is designed for long range, deep or shallow water applications and can release loads as heavy as 227 kg at the full rated depth of 6700 m. The SM-75 functions to assist in its own relocation as it can be commanded to operate as a transponder for measuring slant range. As a transponder, the SM-75 transmits replies to interrogation transmissions from the Deck Box, and the two-way travel time of the sound propagation is measured and converted into the one-way distance. The battery life is up to two years, depending on the number of transponder replies and the amount of data transmitted and received. The SM-75 is released by a command from the ATM-891 Deck Box, which is connected over a serial interface to a host processor, usually a PC. Tele sonar PC, which is provided with the ATM-891, is a graphical user interface (GUI) software program that runs on a PC and provides a user friendly means of configuring and operating the release and the modem.

B. *UDB- 9000 Universal Deck Box*

The Universal Deck Box is a complete single-unit replacement some of the previously offered Benthos acoustic deck box units, including the DS-7000, DS-8000, and ATM-891. The main application of using Universal Deck Box is, it has been designed to work with all acoustic releases, modems, including the SMART products. Some of the Universal Deck Box, (UDB-9000), provides two RS-232 serial ports for data/command line interaction and for direct connection to a PC or laptop and a large grey-scale touch screen for simple graphical user control and enhanced sunlight readability this is used to send and receive commands.AC/DC or internal battery power. Speaker for listening to acoustic signals.

C. Measuring The Size Of The Earth Quake Using Richter Scale

An earthquake occurs when earth releases energy suddenly in the form seismic waves. The tectonic (also called lithosphere plate) plates are the pieces of earth’s crust which are almost hundred kilometres in thickness get dislocated because of seismic waves. The intensity of earthquake is measured with the help of seismometers i.e., Using Richter Scale. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. The Richter magnitude scale, is usually expressed in whole numbers and decimal fractions. Earthquakes can occur anywhere between the Earth's surface and about 700 kilometres below the surface.

In figure2. Seismograph Body waves include P (primary) waves and S (secondary) waves. These are the waves that do the most damage to our buildings, roadways etc.,

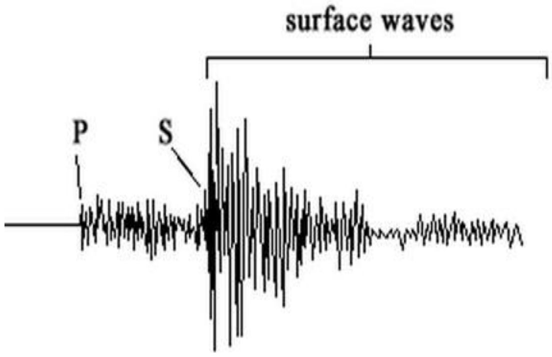

Figure 2: A Seismograph

The size and depth(measured in km) of an earthquake can be determined from the sP phase in the same manner as the pP phase by using the appropriate travel-time curves or depth tables for sP phase. If these two (Sp and pP) waves can be identified on the seismogram as shown in fig., an accurate focal depth can be determined.

Seismic Monitoring and Data Collection

On the contrary, from the proposed model, the underwater network is remotely accessible from the Internet.i.e, SM-75 modems are placed under sea floor, and this can transmit data wirelessly. These modems can communicate each other by using sound waves as such as how the dolphins communicate. These underwater modems, that transmitting data to the modem on the sea surface, then to the laptop (Linux device driver).By getting this data wirelessly we can predict that earthquake is going to occur or not. Then this data is given to satellite and onshore link from the sea surface. For instance, when magnitude value is greater than two then it is detected as earthquake, and this information will be available to everyone in real time that sends message indicating that earthquake is going to occur, with a help of smart phone or computer could save lives. Oceanographic data collection sensor network is of delay sensitive .In disaster prevention systems are optimized for rare communication.

The table for seismic monitor according to Richter scale as follows,

Table 1: Richter Scale

Magnitude Value	Description	Effect	Affected Places				Freq. Per Year
			In World	***Year***	***Mag. Value***	***Rupture Length In Km***	
0.0-2.0	Micro	Recorded In Seismo- Graph People Cannot Feel					Over Millions
2.0-2.9	Minor	No Damage Few People Feel	Indone sia	2014	2.7	10.0	Over 1 Millions
3.0-3.9	Minor	Object Inside House Will Shake Some People Will Feel	Califor nia	2014	3.6	7.5	Over 100,00
4.0-4.9	Light	Object Inside House Will Shake And Fall Most People Will Feel	Califor nia	2014	4.6	8.7	10,000 To 15,000
5.0-5.9	Moderate	Can Damage Or Destroy Weak Buildings Everyone Will Feel	Alaska	2014	5.7	12.0	1000 To 1500
6.0-6.9	Strong	Damage Buildings Wide, Spread Shake From Epicentre	Mexic o	2014	6.9	60.0	100 To 50
7.0-7.9	Major	Wide Spread Damage In Most Areas	Solom on Islands	2014	7.6	22.6	10 To 20
8.0-8.9	Great	Wide Spread Damage In Large Areas	Chile	2014	8.2	25.0	About 1 Year
9.0-9.9	Great	Severe Damage To Most Buildings	Alaska	1964	9.2	1000	1 Per 5-50 Years
10.0 Or Greater	Massive	Not Recorded	-	-	-	-	Not Recorded

Summary

By the proposal of a new underwater networking architecture that enables support for a traditional TCP/IP protocol stack.

An earthquake early-warning (example, earthquake is going to occur go to safe place via., laptop, smart phone etc.,) may provide the critical information needed

1. To minimize loss of property and lives,
2. To aid rescue operations, and
3. To support/help from severe earthquake damage such as buildings, railways etc.,

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