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Design and Implementation of Low Cost Maritime Boundary Identification System Using Fiber Optic Technology

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Abstract: Everywhere on this planet hair-thin optical fibers carry vast quantities of information from place to place. There are many desirable properties of optical fibers for carrying this information. They have enormous information-carrying capacity, low cost and possess immunity from many disturbances that can afflict electrical wires and wireless communication link. Optical fibers have become a widely used aid to navigation worldwide and its useful tool for map-making, land surveying, commerce, scientific uses, tracking, surveillance and hobbies such as geocaching and way marking. None of the present optical fibers systems satisfy the requirements for the safety of civilian navigation in the sea as the maritime boundary of a country cannot be marked. This paper deals on the versatility and the usefulness of optical fibers in the sea. The main objective of the paper is to help the fishermen not to navigate beyond other country's border. If a fisherman navigates beyond the country's border, an alarm is generated indicating that the fisherman has crossed the border. Additionally, a laser transmitter interface will send a message to base station located on the shore indicating that a vessel has crossed the border. Thus guards in the shore can assist and provide additional help to those fishermen if needed. Keeping in mind about lives of Indian fishermen, this device has been created to help them not to move beyond Indian. On the whole, it is an attempt to build a suitable device for the fishermen at a reasonably low cost.
Keywords: Fiber Optic, Laser, FDDI networks, SONET

I. INTRODUCTION

The Tamil Nadu factor in India-Sri Lanka relations that had been quiet for long has come to the fore in the form of the fishermen issue. Frequent incidents of fishermen from Tamil Nadu getting shot in the Sri Lankan's maritime boundary have enraged all citizen of the state. From Tamil Nadu about 18,000 boats of different kinds conduct fishing along the India-Sri Lanka maritime border. Ever since violence broke out in Sri Lanka two decades ago, fishing activity has not been peaceful. Tamil Nadu fishermen are arrested, or shot, by the Sri Lankan Navy. From the fishermen's point of view, straying takes place inadvertently, due to sheer ignorance about maritime boundaries. At times, the drift is because of engine failure or strong currents. At the same time however, quite a few Indian fishermen engage in free floating to exploit marine resources in Sri Lankan waters, knowing full well, the risks involved in crossing the International Maritime Boundary Line (IMBL). Growing markets for marine resources has forced Tamil Nadu fishermen to take risks. Laser is increasingly being used for a wide range of applications. It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth. None of the present optical systems satisfy the requirements for the safety of civilian navigation in the sea as the maritime boundary of a country cannot be marked. This paper add on the versatility and the usefulness of an optical cable in the sea. The main objective of the paper is to help the fishermen not to navigate beyond other country's border. If a fisherman navigates beyond the country's border, an alarm is generated indicating that the fisherman has nearing the border.

With this alarm, the fisherman can be caution and come back inside the country's border. Additionally, a message transmitter is interfaced with the device to send a message to base station located on the shore indicating that a vessel has crossed the border. Thus guards in the shore can assist and provide additional help to those fishermen if needed.

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II. EXISTING SYSTEM

At present, there are few existing systems which help to identify the current position of the boats/ships using GPS system and view them in an electronic map. GPS provides the fastest and most accurate method for mariners to navigate, measure speed, and determine location. This enables increased levels of safety and efficiency for mariners worldwide and accurate position, speed and heading are needed to ensure the vessel reach its destination safely. The accurate position information becomes even more critical as the vessel departs from or arrives in port. GPS receiver which receives signals from the satellite and gives the current position of the boat. With already known details of the latitude and longitude of the maritime boundary, the microcontroller calculates the current position and stored boundary positions and indicates the fisherman that he has crossed the boundary by an alarm system.

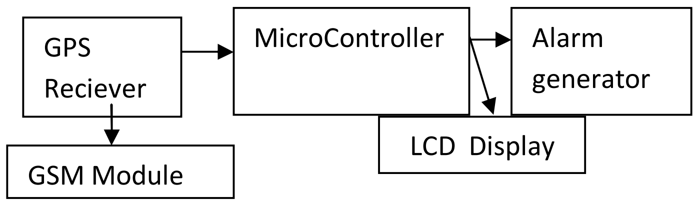

Fig1. Block diagram of Existing System

III. PROPOSED SYSTEM

The proposed system is used to detect the maritime boundary of the country where the long time dispute between Sri Lanka and India still exists. This mainly happens when fisherman crosses maritime border of neighboring country as he is not aware of the limits in sea. A laser emits light in a very narrow beam– much like a searchlight. Laser light is very spectrally pure -- it is of a very pure, well-defined color -- and is very bright. These properties make a laser ideal for shining light from place to place over long distances, and it was soon proposed that this provided new opportunities to expand the usefulness of optical communication links Every compact disk player contains a low-cost, semiconductor laser, whose beam illuminates the pattern of information encoded into the surface of the CD and allows its rapid re-translation into music or computer data.. The most widely used type of laser is the semiconductor laser, which has much in its technology in common with the semiconductor devices that we use in modern electronic devices. The principal difference between these two semiconductor technologies is that conventional electronic semiconductors are almost exclusively based on the element silicon, whereas semiconductors used in lasers (and related so-called optoelectronic devices) are based primarily on mixed semiconductors made up from gallium (Ga) and arsenic (As) , and often aluminum (Al) as well. It is semiconductor lasers made up from GaAs / GaAlAs that provide the light for optical communication along optical fibers. This phenomenon causes light to *reflect*, rather than *refract*, when it attempts to cross the boundary from one transparent optical medium to another of lower optical density, at a sufficiently large angle. He did this by showing light being guided along a stream of water flowing from a container. His simple demonstration proves that in the right circumstances *light need not travel in straight lines.*

IV. DISTANCE CALCULATION

The distance the vessel has travelled can be calculated from the starting point of the vessel. This allows the fisherman to know how much distance he has travelled from the shore. This calculation can be done on basis of the
Harversine formula.
R=earth's radius(mean radius=6,371km)
$diff\_lat=lat2-lat1$
$diff\_long=long2-long1$
$a=\sin^2(diff\_lat/2)+\cos(lat1).\cos(lat2).\sin^2(diff\_long/2)$
$c=2.atan2((a)^{(½)},(1-a)^{(½)})$
distance = R*c

Buzzer

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Buzzer is used to indicate that the vessel has crossed the border. Buzzer is connected to NPN transistor. The ground connection is given to buzzer. The 5V is connected to transistor. Under normal conditions, i.e., when vessel is inside country's border, current flows through emitter. And hence, buzzer is not activated. When vessel crosses border, circuit is closed and current flows to buzzer. Thus alarm is generated.

A. Total internal reflection

When a ray of light passes from one transparent medium to another, i.e. at the surface of a pool of water, it generally bends at the boundary. This phenomenon is well known: a stick poked into water appears to bend. The bending of the ray at the boundary is described by Snell's law, a simple relationship between the sines of the angles that the ray makes on the two sides of the boundary. Mathematically, Snell's law can be written as:$n_1 sin\square_1=n_2 sin\square_2$where $\square_1$ is the angle of the ray on one side of the boundary, as shown in Fig.(2), and $\square_2$ is the angle on the other side. The quantities n_1 and n_2 are the *refractive indices* of the media on opposite sides of the boundary.

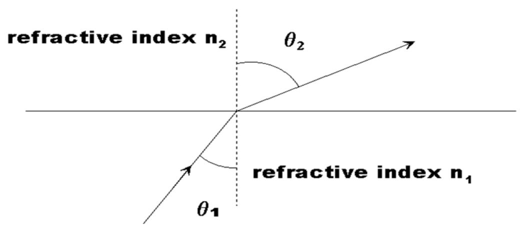

Fig.2 Internal Reflection

The *refractive index* of each medium is a number that characterizes the optical density of the medium relative to a vacuum. It is a number that describes how much more slowly light travels in the medium relative to its velocity in a vacuum. If n_2 is less than n_1 this equation restricts the angles at which a ray of light can get across the boundary.

If light is passing from medium 1 to medium 2 and the angle $\square_1$ is greater than the *critical angle*, then the light can not refract across the boundary (because $\square_1$ can not be greater than 90^o). The critical angle is the angle whose sine is n_2/n_1. When a ray of light strikes a boundary at an angle greater than the critical angle it reflects, and does not cross. Although many devices that we use in real life use this phenomenon, and although many natural optical phenomena depend on its occurrence, we may not be aware of it. A simple example can be given, which involves what a swimmer sees who is underwater and attempting to look upwards through the surface.

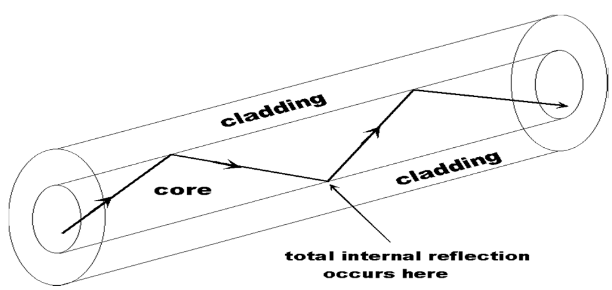

Fig.3. Swimmer's point of view

Optical fibers use total internal reflection to keep a light ray trapped within the denser glass of the center of a composite cylindrical glass fiber, the *core*. It is as if light rays are guided down the core of the fiber in a zigzag path by a succession of total internal reflections at the boundary between the core glass and the less dense glass surrounding it – the *cladding*.

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A. Maritime Boundary between India and Sri Lanka

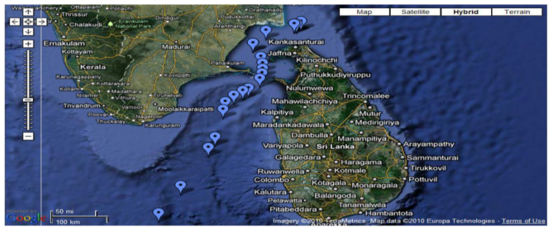

Fig. 4,. Graphical

1) A Key Technological Development - Extremely Transparent Glass: Conventional window glass, whether it be soda-lime glass or borosilicate (Pyrex), is not really very transparent. It only appears so because we usually use it in thin sheets – typically a few millimeters thick. If you examine a piece of such sheet glass by viewing it from the narrow edge it is easily seen that the glass has a deep green or brown color when viewed in thicknesses of several centimeters. Even so, glass not much more transparent than this was used, as early as 1957, to make fiber imaging bundles. In these structures, which were primarily developed for medical imaging, a large number of optical fibers are bonded together to make an aligned bundle. An optical image projected onto one end of the bundle is relayed along the bundle, and appears at the far end, where it can be viewed. For viewing distances of a few tens of centimeters, the amount of transmitted light reaching the far end of conventional glass was sufficiently large to allow these imaging bundles to be used for looking into confined spaces, Attenuation (dB)= 10 log(P_1/P_2). In the example above the attenuation of the fiber is 1000 dB per km (1000 dB/km). Clearly, a fiber with so much attenuation is useless for long distance light transmission. In the early 60s it was quickly realized that unless more transparent glass could be developed, it was merely a dream to contemplate the use of glass fibers to carry information optically over long distances.

Kao and Hockham's work spurred the efforts of others and in 1970 scientists Donald Keck, Robert Maurer, and Peter Schultz at Corning Glass achieved the attenuation figure of 20 dB/km. By 1975 this figure was down to 4 dB/km. Attenuation in state-of-the-art fibers has declined steadily since then, reaching 0.5 dB/km in 1976 and 0.2 dB/km in 1979. This last figure can be put into perspective by pointing out that for a fiber 10km long with an attenuation of 0.2 dB/km, about 63% of the light reaches the far end of the fiber. Imagine still being able to see quite clearly through a window 10 km thick! The development of fibers possessing such low attenuation has provided optical communication systems with the information carrying channel that they need. It cannot be stressed too strongly how the efforts of glass scientists have made possible the information technology age.

Reductions in attenuation of modern fibers have been accomplished by developing optical fiber fabrication techniques that eliminate impurities, particularly hydroxyl ions when the lowest attenuations are required. It should be acknowledged that the lowest attenuation levels have not been achieved for visible light but at two wavelengths in the near-infrared part of the spectrum, near 1.3 micrometers (μm) and 1.55 μm. Fig.(5) shows the variation of attenuation with wavelength of a typical modern fiber . The attenuation in the near-infrared is close to the minimum achievable values, which are determined by fundamental physical phenomena in the glass, which are not determined by impurities.

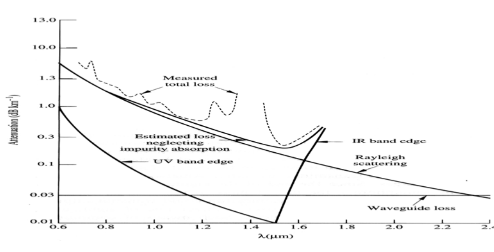

Fig. 5

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V. ABSORPTION IN OPTICAL FIBERS

Residual absorption in low loss modern optical fibers comes from several sources: residual ultraviolet absorption, residual infrared absorption, and *Rayleigh* scattering. Hydroxyl ions (OH^-) absorb light near 2.73 μm, with weaker absorptions at 1.39, 0.95 and 0.72 μm. The hydroxyl content must be kept below 1 part per million (ppm) in order that the attenuation at 0.9 μm be less than 1 dB/km. Even if the water content of the fiber is minimized, residual absorption remains from the infrared absorption of the fundamental vibrations of the bonds that make up the glass, which occur at 7.3 μm for boron-oxygen bonds, 8.0 μm for phosphorous-oxygen bonds, 9.0 μm for silicon-oxygen bonds, and 11.0 μm for germanium-oxygen bonds. These absorptions influence the attenuation of the fiber even at shorter wavelengths. The remaining significant, unavoidable attenuation mechanism in the fiber is Rayleigh scattering -- the natural tendency for any atom or module to reradiate in all directions a part of the electromagnetic radiation incident on it. The magnitude of this scattering increases dramatically at shorter wavelengths, and is enhanced by the random structural character of glass. Indeed it is this phenomenon that causes the sky to appear blue: the shorter wavelengths in sunlight (the blue light) scatter more strongly than other colors. Microscopic variations in material density in a glass fiber lead to concomitant variations in refractive index that enhance Rayleigh scattering. This loss can be minimized by drawing the fiber during production so as to minimize compositional variations.

VI. WHY ARE OPTICAL FIBERS SO GOOD FOR COMMUNICATIONS?

The information-carrying capacity of an optical fiber is far greater than it is for its competitors: wires, coaxial cables, and microwave links. In addition, optical fibers are inexpensive to produce, do not conduct electricity (which makes them immune to disturbance by lightning storms, and other electromagnetic signals – except nuclear radiation), do not corrode, and are of small size. The primary reason that optical fibers have very much larger information-carrying capacity than other media, is that they carry light: this might seem a trivially obvious observation but it has fundamental significance. The frequency of the light beams that travel along optical fibers is in the vicinity of two hundred trillion cycles per second (Hz). Compare this with the frequency of the latest generation of personal communication service (PCS) cellular wireless systems – approximately two billion cycles per second (2 GHz). Consider the frequencies that must be transmitted for voice communications, which cover the range (bandwidth) from about 50Hz to 20,000Hz (20kHz). Indeed, since there is very little need to include the high frequencies for understandable voice communications, the actual bandwidth needed is really only about 4 kHz. It is possible, in principle, to carry about 50 billion voice conversations on a single laser beam in an optical fiber. This capacity results from the very simple calculation:

$2.10^{14}\text{Hz}/4.10^{3}\text{Hz}=50.10^{9}$.

The entire population of the Earth could be on the phone on a single fiber at the same time! The corresponding capacity of a PCS link is about 500,000 simultaneous voice channels. In practice, it has not proven possible to achieve these maximum capacities, although in current links the optical fiber wins by a huge margin.

VII. DIGITAL ENCODING OF INFORMATION

Many years ago all information was transferred in an *analog* format, which meant that the message was transmitted essentially as an exact copy of the original. The best example comes from early telephones. When a person spoke on the telephone, a microphone in the handset converted the sound waves from the voice into an electrical signal (varying electrical voltage or current), which mimicked the variations in air pressure produced by the persons's voice. This analog signal was sent along electrical wires to its destination, where the electrical signal drove a small loudspeaker and recreated the sound of the caller's voice. The principal problem in this scheme was that the electrical signal became distorted in its passage from caller to listener. Consider a short duration record of a voice. This could be a time-varying voltage of the form shown schematically in Fig.(5). At each instant of time, the magnitude of the voltage has a specific value, which can be represented as *V(t)*. This voltage can on an arbitrary scale be represented by a normal decimal number, say *N(t)*. If we convert the number *N*into the binary system then it will be written as a series of "ones" and "zeros," called *bits*. For example, if *N*=59, then we can write:59=32+16+8+2+1,which can be seen to be$59=2^5+2^4+2^3+2^1+2^0$.So, the binary representation of 59 is 111011. Note that the "ones" show up where the appropriate power of 2 is needed to build up the

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number. This binary number could be represented by the binary voltage signal shown in Fig.(6).

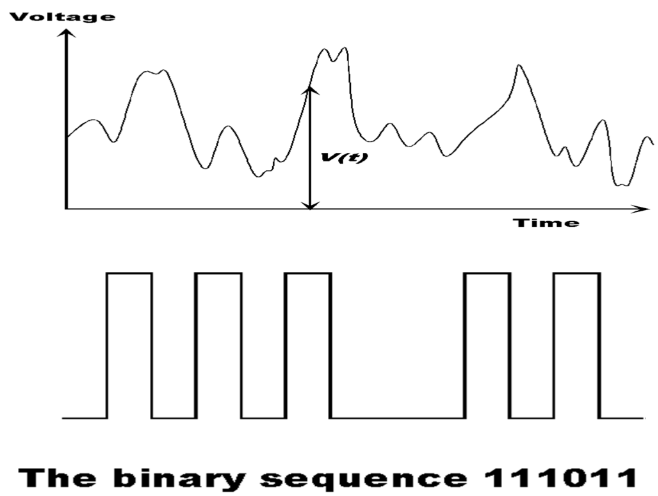

Fig.6

If we take the values of *V(t)* at equally spaced time intervals, and represent each value of the voltage by its binary voltage signal, then we can create a continuous binary representation of the original analog signal. This is called analog to digital conversion (A/D). To make this binary representation an accurate record of the original signal there must be sufficient samples of the analog voltage taken, and each must be encoded by sufficient binary bits.. In addition, samples should be taken at twice the maximum frequency it is desired to include in the representation of the signal. So, for example, speech digitized at 8 bits (2^8=256) to include frequencies up to 4kHz would produce a bit rate of 64,000 bits per second (b/s). (64,000=8X4,000X2.) Music digitized at 16 bits to include frequencies up to 20kHz would need a bit rate of 640,000 bits per second.

It is worthwhile considering for a moment the number of bits of digital data associated with the transmission (or storage) of various kinds of information. A compact disc (CD) with one hour of music typically contains about 680 Megabits (Mbs) of digital data . A computer CD ROM contains a similar quantity of data. Video requires somewhat larger numbers of bits per hour, because both the picture and accompanying sound must be stored. However, clever techniques for compressing the imagery can reduce the quantity. The latest generation of digital video discs carry 4.7 Gb of data per side. Double sided, double layered DVDs can carry four times as much data – more than 17 Gb of data. A single-sided, single-layered disc, stores 133 minutes of film (with accompanying audio), so the average rate of data transfer during viewing is about 0.6 Mb /s.

For real time video transmissions the rate of data transfer required is higher, in the range from 3 to 5 Mb/s. To download a 2 hour long DVD movie over a link within 10 seconds requires a data transfer rate of around 0.5 Gb/s. You can't get such data rates through your phone line! However, if optical fiber is installed directly to your home this changes your access to information directly. Fiber-to-the-home, as it is called, is not yet here because of the cost involved – estimated to be around $1,000 per household. The telephone and cable companies have not identified a current demand for digital communication services that needs the data rates provided in this way. The technology to do it is here, but not the will for the capital investment required.

VIII. REPEATERS AND DISPERSION

This process was traditionally carried out with a *repeater*. This is a device incorporating a light detector, processing electronics, and a new laser. An incoming stream of optical pulses, corresponding to the transmitted information in binary code, is detected and becomes an equivalent stream of electrical pulses. These electrical pulses are amplified, reshaped electronically to restore their original shape, and are then used to drive the new laser to re-transmit the information along the next stretch of fiber.

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In this way, a stream of optical pulses can be transmitted over great distances, such as under the Atlantic Ocean, by spacing a series of repeaters along the fiber cable. Typically repeaters are spaced every 45-70 km. Consequently, a long fiber cable must incorporate conventional electrical wires to provide the power to drive the repeaters.

One great advantage of a system with repeaters is that it has the ability to restore their original shape to propagating light pulses. There is a natural tendency for an optical pulse traveling along an optical fiber to change its shape. This results from a phenomenon called *dispersion*. short optical pulse always contains a range of wavelengths. Although this might not be obvious, an analogy can be made. A pure musical tone, in its ideal form gives a sound wave that undulates at a distinct frequency, for example middle C is 523.25 Hz.

If the pulses were able to spread to a width of 1ns they would overlap, and their distinct identity in the pulses stream would be lost. If these pulses are detected at a repeater before they have spread too much, their original 0.5ns width can be restored, and the pulses will not continue to broaden in traveling great distance along a fiber. This is the clear advantage of a fiber system with repeaters. However, there is a disadvantage to repeaters: they can not distinguish pulses at one wavelength from pulses at another wavelength..

IX. ERBIUM DOPED FIBER AMPLIFIERS (EDFAs)

In 1987 David Payne and his co-workers at the University of Southampton in England reported the operation of the first practical optical amplifier suitable for lightwave communication systems. The EDFA uses an optical fiber with the rare- earth ion erbium added as an impurity. If optical energy is fed into a section of such a fiber, which uses an auxiliary laser (called the pump laser), than a stream of optical pulses will pass through the amplifier and each pulse in the stream will be amplified (boosted in size). This amplification process occurs for a relatively broad wavelength range near 1.55 □ m

The development of low loss, low overall *dispersion*, *single-mode* fibers, with EDFAs to allow long distance transmission, may serve to satisfy the world's insatiable appetite for ever-increasing data rates. This is graphically illustrated by Fig.(7), which shows how the data rates of communication channels have grown since the early days of the telegraph. This figure was drawn in 1995, and is already out of date.

The projected capacity of a single fiber communication channel of 10^{12} bits per second (1 Terabit/s), which the figure above suggests will happen around 2,005, is already here. Worldwide Internet traffic is about 1 Terabit per second, and could therefore, in principle, be carried on a single optical fiber. A typical optical fiber cable containing 8 distinct fibers will carry 8 Terabits per second, or 20 million Terabits per month.

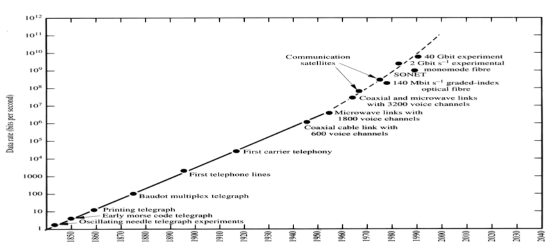

Fig 7.

X. OPTICAL COMMUNICATION NETWORKS

Fiber optic links have been extensively installed worldwide. Most long distance (trunk) lines use single-mode fiber and increasingly high data rates. A current standard is the 2.488 Gbit/s maximum data rate of SONET (synchronous optical network). A typical SONET optical fiber link will carry 32,000 simultaneous two-way voice or data channels on one pair of fibers. SONET is designed

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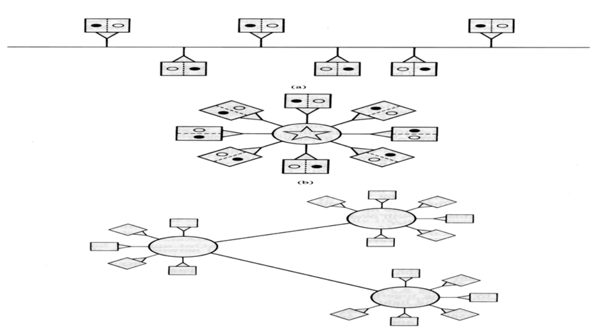
to interface with and replace existing communication networks that operate at various data rates. The lowest level SONET signal is called the Synchronous Transport Signal Level 1 (STS-1), which has a data rate of 51.84 Mbit/s. Higher data rates are achieved by multiplexing N of these data streams up to a maximum of N=48. SONET uses single-mode fiber and different types of light source depending on the ranges involved. Short reach links (up to 2 km) use *light emitting diodes*(LEDs) or multimode lasers operating at 1.31 □ m; intermediate reach links (up to 15 km) use 50 □ W single- or multi-mode laser transmitters operating at 1.31 □ m or 1.55 □ m. Long reach links (up to 40 km) use 500 □ W laser transmitters at 1.31 □ m or 1.55 □ m. For local area networks (LANs) that use LED sources and multimode fiber the Ethernet standard (3 Mbit/s) is widely used, although when higher data rates are required the Fiber Distributed Data Interface (FDDI) standard is common.

A. Trans-Ocean Optical Fiber Cables

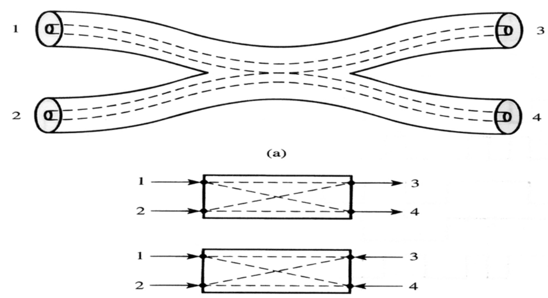
The longest fiber links are those that span the world's oceans, including several across the Atlantic from North America to Europe and several from the United States to Japan. Many additional long distance fiber links exist: by 1995 there were nine across the Atlantic, four from the United States to Japan, one from Japan to China, with additional links for Australia, Korea, India, South and Central America, South Africa, and New Zealand . The transatlantic cable laid in 1988 (TAT-8) contains eight fibers and can carry 40,000 telephone calls at one time: each pair of fibers carries 560Mb/s. The next generation of cables (TAT-9 and TAT-10), which came into service in 1992, carry double this number of calls. TAT-11 has the same capacity as TAT-9 and TAT-10. It stretches 7,162 km from Manahawkin, New Jersey to a location 600 miles from both Ireland and France where it splits and continues to Swansea, in the U,K, and St. Hilaire in France. The newest trans-Atlantic cable TAT-12/13 is the first such cable to use EDFAs rather than the old-style repeaters. This cable forms a ring of undersea segments connecting together cable stations in Green Hill, Rhode Island; Lands End, England; Penmarch, France; and Shirley, New York. It is 12,400 km long. The segment from Green Hill to Lands End is 5,913 km long. One segment of the cable 3,759 km long was installed by STC Submarine Systems. There are 133 EDFAs spaced 45 km on the remaining segment 2,154 km long installed by AT&T Submarine Systems. Each of the cable segments contains two fiber pairs, one used for regular service, and the other for emergency restoration service. The capacity of each fiber pair is 2.5Gb/s, so the overall capacity of the system is 10 Gb/s. The two main cables are laid several hundreds of kilometers apart on the ocean floor, and are routed to avoid hazardous areas, surface and deep-sea current, seismic activity, military activity, and fishing. Tyco Submarine Systems (TSSL) announced that a doubling of capacity of TAT-12/13 would be achieved by July 1998 by upgrading it to 2-wavelength WDM operation. An extension to a third wavelength, which would increase capacity to 30 Gb/s, is being considered for July, 1999. It could carry 7.7 million telephone calls at the same time. About 80% of the cable capacity will be allocated to Internet and multimedia traffic. If one considers that the lowest typical price for a Trans-Atlantic telephone call is 10 cents per minute, and probably averages in reality about $1.00 per minute, then the cable pays for its installation costs in about 24 hours!. Because carriers can charge more for high speed connections the system (if fully utilized) probably makes back its installation costs in about 12 hours! The two cables are laid 740 km apart. This cable was a joint venture of Cable&Wireless and WorldCom.



B. Optical Fiber Network Architectures

Three popular topologies of optical networks. In these arrangements of transmitters and receivers, each transmitter/receiver pair on the network, which is called a*node* or *subscriber* can communicate with every other. The construction of such networks relies on the use of various passive optical components for their implementation. The most important of these is the fiber coupler, that either splits or combines optical signals. This is a four-port device. In the simplest sense such a device is fabricated by fusing together two single mode fibers so that their cores come close together, allowing light to leak from one core to the other. Depending on the splitting ratio between the ports the device can be described as either a *tap* or *splitter*.

if light enters port 1 it is split on output between ports 3 and 4. Port 2 functions in the same way, although usually one of ports 1 or 2 will be unused if it is desired to act as a *Y* (or *T*) coupler. If the intensities leaving ports 3 and 4, respectively, on injection of light at port 1 are equal the coupler is referred to as a 3 dB coupler or splitter, on the other hand if 99% of the input power passes from port 1 to port 3, with only 1% leaving at port 4 the device is described as a 20 dB coupler or tap.



C. Line-Of-Sight Optical Links

Line-of-sight optical links, which involve the free space propagation of the encoded light signal from source to receiver, have only limited, short range application in ground-based situations. Turbulence, scattering, and absorption by the atmosphere introduce amplitude and phase noise into the transmitted signal and cause significant signal amplitude decay over moderate distances. However, ground-to-satellite, satellite-to-satellite, and deep-space communication links represent important application areas for line-of-sight optical communicationsThe most challenging application of such a link is in deep-space communications. In explorations of the outer planets in programs such as Pioneer and Voyager, data is relayed to and from the space craft with microwaves. Because the transmission distances are so long, high transmitter powers are required, which presents a problem for the space craft end of the system, which must rely on solar power. If a short wavelength laser is used as the transmitter on the spacecraft, a substantial reduction in transmitted power is possible because a more directional beam is possible.

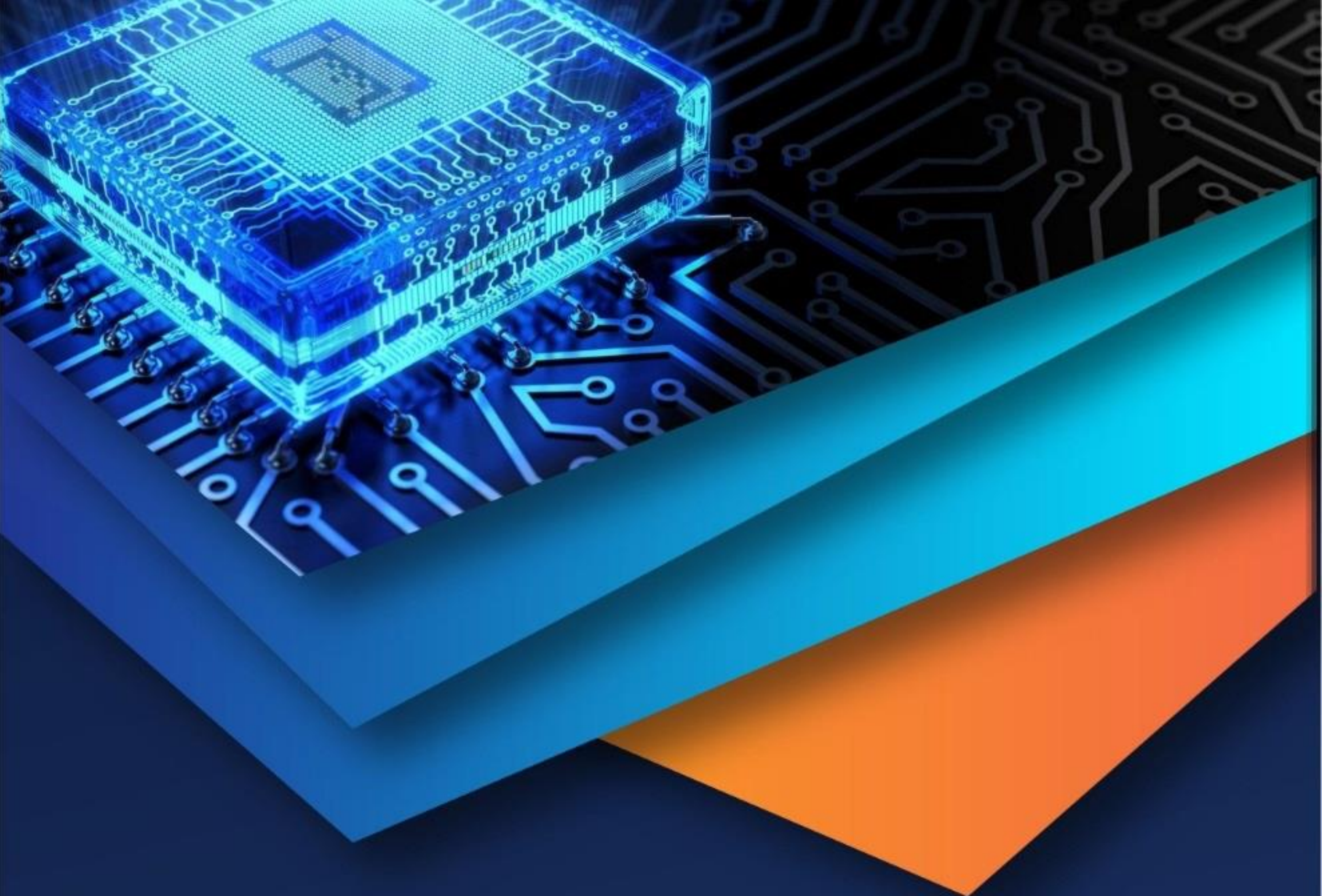
XI. CONCLUSIONS AND FUTURE ENHANCEMENT

It is a useful device for safer navigation, especially for fishermen. Since Sri Lanka and India have got lots ofproblems regarding the maritime boundary of the country, this device is made to identify the maritime boundary and to provide assistance if needed. The main advantage of this paper is compact and low cost.

Our paper can be extended to advance future components and PIC microcontroller, so that it can be widened to largeapplications with more accurate results. The design of the device can be made even smaller than proposed by modifying the design specifications. Efficiency can be improved by implementing more accurate laser.

REFERENCES

[1] HARVERSINE FORMULA: http://en.wikipedia.org/wiki/Harversine_formula
[2] Shwu-Jing Chang "Vessel identification and monitoring systems for maritime security". This paper appeared in: Security Technology, 2003. Proceedings, IEEE 37th Annual 2003 International Carnahan Conference, 14-16 Oct. 2003.
[3] GPS-based vessel position monitoring and display system. This paper appears in: Aerospace and Electronic Systems Magazine, IEEE Publication Date: Jul 1990.
[4] Practical aspects of Embedded System Design using Microcontrollers by Jivan S.Parab, Santhosh A.Shinde, Vinod G.Shelake, Rajanish K.Kamat, Gourish M.Naik.



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