

# Developing Subsea Communication using Fiber Optics

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**Abstract:** Optical Cable maintenance must be under care at least once in a year. Additional Man-Power will create minor impact to the existing protocol since persons are required to support over all power backup and system maintenance but, when compared to the profit ratio this factor is purely negligible. This technology is developed to overcome and avoid time delay in controlling the subsea equipment. To remove the issue of hydraulic fluid discharge. To avoid subsea accumulation in deep water. To reduce the overall cost of the project as the time of the project is reduced. To avoid long residence time in long umbilical leading to degradation of fluids (flocculation). To develop new technology which will pave a way to wireless communication using optics in future? To avoid issues from fluid contamination. Precise data Log can be Maintained. Hydraulics controlled through optical fiber technology will tremendously decrease the time delay when compared to existing high pressure steam control valves. On Implementing IoT, this system can be securely handled globally from anywhere in the world. In case of Network crash of Internet Protocol Failure an emergency password protected manual control unit will do the job in next fraction of seconds. Whole system will be under systematic control and the cost of the existing mechanism will be reduced nearly to 200 percent. There is minor chance for error rate of nearly 5% when compared to the present traditional subsea equipment success rate. This can only be improvised based on the upcoming network technologies. Optical Cable installation cost will be highly complex. 24x7 Power backup must be maintained from substation. National Firewall should be under surveillance and it must be protected against black hat hackers.

**Keywords:** Arduino IDE, IOT, Optical cables.

## I. INTRODUCTION

A submarine communications cable is a telecommunications cable constructed on the seabed between land-based stations to deliver telecommunication signals across oceans and seas. Beginning in the 1850s, the earliest undersea communications cables transported telegraphy traffic, enabling the first immediate telecommunications links across continents, such as the first transatlantic telegraph cable, which went live on August 16, 1858. Following generations of cables carried phone traffic, followed by data communications traffic. Optical fibre technology is used in modern cables to convey digital data, such as telephone, Internet, and private data traffic. For the deep-sea parts, which make up the majority of the run, modern cables are normally 25 mm (1 in) in diameter and weigh roughly 1.4 tonnes per kilometer (2.5 short tons per mile; 2.2 long tons per mile), however larger and heavier cables are used for shallow-water sections close shore. When Java was connected to Darwin, Northern Territory, Australia, in 1871, in anticipation of the completion of the Australian Overland Telegraph Line in 1872, connecting to Adelaide, South Australia, and then to the rest of Australia, submarine cables first connected all of the world's continents (except Antarctica).

Undersea cables currently carry 99 percent of the data traffic that crosses the seas. Submarine cables have a high level of dependability, especially when numerous pathways are available in the case of a cable break (as mentioned above). Submarine cables have a total carrying capacity of terabits per second, but satellites normally give only 1,000 megabits per second and have a greater latency. A typical multi-terabit transoceanic submarine cable system, on the other hand, costs several hundred million dollars to build.

These cables are highly prized not just by the businesses who create and operate them for profit, but also by national governments, due to their low cost and utility. The Australian government, for example, deems its undersea cable systems "essential to the national economy." As a result, the Australian Communications and Media Authority (ACMA) has established protection zones that limit activities that may cause harm to the cables that connect Australia to the rest of the world. The ACMA also oversees all initiatives including the installation of new underwater cables.

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In oil and gas industry, though the technology has developed so much in the 21st century we are using the same old traditional way of communicating underneath the subsea using hydraulics, which takes quite a long time to communicate from topside do the subsea Equipment but produces 100% success rate. Many researchers are working on to develop the subsea communication system using Wi-Fi, but due to several factors, Wi-Fi does not travel underneath the sea. As the first step for wireless Communication, I am using optical fiber (wired) as a medium of communication and developing the speed of Communication and controlling the subsea Equipment. This project focuses on developing the speed of Communication and controlling the subsea Equipment using Fiber optical as a medium, which is already present in the subsea umbilical. I have developed a device which can retrieve the message from optical Fiber and open the valve manually underneath the sea within a maximum time span of 13 seconds.

## II. LITERATURE REVIEW

The paper presents the results of experimental studies of a transportable measuring instrument supported by 2 mechanical phenomenon fiber-optic accelerometers with a multi-turn optomechanical electrical device placed in a Zehnder fiber-optic measuring device arm used as a sensitive component. Passive section reception with a fiber-optic splitter three-three enables the recording of measuring device output signals in the presence of thermal drift. The likelihood of recording mistreatment in such acoustic and hydro acoustic pressure gradient systems is shown [1]. An epitome of a mobile fiber-optic measuring instrument during which a multiturn optomechanical electrical device placed in an exceedingly fiber-optic Mach-Zehnder measuring device interferometer arm is employed as a sensitive component is developed and studied. Passive section reception employing a fiber-optic splitter three-three maintains stable measuring instrument operation in the case of a temperature drift of AN in operation. The detectability of weak hydroacoustic signals employing a fiber-optic interferometric accelerometer [2] is increased.

In this paper, many scour-watching techniques were supported by active measurement methodology. Firstly, the DS18B20 digital temperature detector was designed to monitor the surface heat modification pattern within the heating method in numerous media like sand and water. The check results validate the practicability of the active measurement methodology. Then, the submarine pipeline scour watching system supported by the Brillouin distributed optical fibre sensing technique was developed. As a result of the high value of the monitoring system of distributed Brillouin fiber optical sensing technology, so as to scale back prices, common armed fiber optic cable was used as each heating and sensing unit, and Raman sensing with a comparatively lower value was employed for distributed temperature sensing for scour watching. Laboratory check results show there's smart potential for active measurement methodology for scour watching in sensible fields [3]. An epitome of a mobile optical maser seismometer supported by a multi-turn fiber-optic sensitive component, an adaptation holographic measuring device has been developed. The likelihood of recording weak, unstable waves propagating within the "land-sea" interface region by the optical maser seismometer is shown. The first multi-turn style of the sensitive component of the seismometer is shown. The first multi-turn style of the sensitive component of the seismometer provides a threshold sensitivity of 1.6 half-dozen m/s<sup>2</sup> to unstable acceleration. The semi-permanent operation stability of the optical maser seismometer is provided thanks to adaptational properties of the measuring device created by employing a dynamic photo fashioned within the photorefractive metallic element titanate crystal [4].

The seismometer supported fiber-optic Mach-Zehnder measuring device is projected and tested. The sensor of the seismometer is enforced as a multiturn optical fibre coil that allowed to get high response to acceleration half-dozen.  $1 \times 10^3$  V/g within the frequency vary 1–20 Hz. Stability of the seismometer operation is provided by feed-back management of the measuring device operating purpose. It's by experimentation incontestable that seismometer is ready to dependably observe unstable vibration with acceleration amplitude at the extent the extent. Risk of additional increase of seismometer sensitivity is discussed [5].

The pipeline industry's and therefore the general public's concerns for a secure and friendly environment are at an incomparable high. This emphasizes the requirement for effective leak detection to avoid environmental disasters and operational interruption. As a result, precise approaches for detection and locating very small leaks that may result in larger breaches are a vital tool in the building of crucial pipelines. External pipeline leak detection systems supported by distributed fiber optic sensing seem to be the most effective choice for detection and localizing very small breaches. For the Kinosis pipeline system, two 11-kilometer electrically heat-copied pipe-in-pipe (EHTPIP) pipelines are installed between the Nexen Long Lake upgrader and the Nexen Kinosis SAGD facilities.

The EHTPIP exterior surface is directly involved with the fiber optic detector wire. These pipes transport created emulsion and boiler feed water at temperatures of up to a hundred and twenty (120) °C and 150 °C, respectively. event of a leak, however, once the electrical heat trace system is turned on, the fiber optic distributed sensing system provides temperature feedback data to the operator; in this case, the watch system will observe and find warming issues and/or signs of heating failures. Once a leak happens, the pipeline's outside temperature rises; this can be instantly recognized and monitored by the DITEST temperature watching system that sends an alarm to the Nexen LONG LAKE upgrader SCADA system for that exact spot. What is more, by combining fiber optic distributed watching with PIP technology, we will observe and find a leak within the inner pipeline at an early stage, avoiding any environmental harm (the leak remains contained by the outer PIP tube) and giving the pipeline operator time to set up a sectional replacement [6].

In this paper, distributed optical fibre sensing systems support hybrid measuring devices to live and find leaks in gas-filled pipelines. The section signal iatrogenic by the gas leaky sound wave will be detected, and then the outflow position can even be calculated from the null frequency of the output spectrum. The mensuration principle and, therefore, the leaky supply location methodology for the hybrid measuring device were analysed. Localization performance was evaluated. The experiment was designed to gauge leak position detection and placement performance. The results show that the fiber optical detector has smart accuracy in the leaky position. The fiber optic easy lay review length is ten kilometres, the leaky hole is a pair of.5 mm, and the force per unit area varies from zero to The location error of the fiber optic detector system is less than 1% at 5.8–1.5 MPa [7].

The layer involves particular signal transmission and reception over the propagation channel. Datalink Link layer---deals with signals at the output of the base station receiver, performs radio resource management, power control, rate allocation, call admission, error control, etc. Network layer: a protocol stack that includes handoff management, location management, traffic management, and traffic control. Application layer: communicating, distributed processes running on end systems (hosts), e.g., e-mail, Web, P2P file sharing, instant messaging. In this survey, they explained the fundamentals of cellular communications. 2. Characterization of

wireless channels. 3. Techniques for mobile radio transmission. Receiving techniques for fading dispersive channels. 5. Various access methods. Management of wireless networks on mobile devices. Interoperability of wireless and wireline networks [8].

The foundations of optical fiber transmission systems are discussed, including the fiber transmission medium, sources that can be used as carriers, modulation and detection techniques, and some system design concerns. Low-loss optical fibers have opened up new possibilities for optical communication. Fibers may soon be employed in communication networks in the same way as wire pairs of coaxial cable are currently. It has been possible to obtain transmission losses as low as 2 dB/km. Experimental fiber repeaters with a 10<sup>-9</sup> error A sustained rate and a pulse rate of roughly 300 Mb/s have been reported. Fiber cabling and splicing are two issues that require novel solutions in order to make a functional system a reality [9].

The current state of fiber optics components is discussed, as are future applications of fiber optic technology. A brief review of the principles of light guiding and the elements that influence light guide performance is offered. The current capabilities of fiber optics are described in terms of attenuation, information capacity, fiber strength, and manufacturing. The current state of optical cables, sources, detectors, and couplers is discussed, as well as suggested and demonstrated solutions. Fiber optics development trends are discussed, as are comparisons and contrasts with other technologies that show fiber optics' economic and technological feasibility. Finally, concluding remarks review the current state of technology and highlight where it is projected to be applied [10].

Resistance may be found in a variety of places, including society, politics, and even friendship. Almost every piece of circuitry has some of this unique property. Resistors are the ones that do a great job of displaying their resistance and are very useful for practical applications when used in measured and specified proportions. But what exactly is this property's "resistance" all about? At least in our situation, we're talking about processes that block the passage of electrical current. The lower the current, the higher the resistance. It appears to be simple, and it typically is, which is why most sources (textbooks, for example) leave it at that. Let's assume we want to change the voltage by going from zero to higher and higher numbers (but in any instance, clearly on the safe side of potentially hazardous levels, frying our breadboard or, even slightly more unfortunately, throwing you into the abominable abyss of cardiac arrest) [11].

Li-Fi is a novel type of wireless communication that employs LED lights to send data wirelessly in an era of overloaded data communication networks. In today's fast-paced society, data transmission is one of the most vital day-to-day tasks. When several devices are connected to the Internet, the existing wireless networks are extremely sluggish. Furthermore, as the number of devices connecting to the Internet grows, restricted bandwidth availability makes it much more difficult to enjoy fast data transfer speeds and connect to a secure network. Radio waves are only a small section of the electromagnetic spectrum that may be used to transmit data. Li-Fi is a light-based variation of Wi-Fi that uses light instead of radio waves to communicate data. Li-Fi would replace Wi-Fi modems with transceivers equipped with LEDs that could illuminate a room while both transmitting and receiving data. Visible light can help relieve the excessive loads that the present wireless system is experiencing by combining the new and underutilized capacity of visible light with the currently available radio frequencies for data transport. Li-Fi is a light-based variation of Wi-Fi that uses light instead of radio waves to communicate data. Li-Fi would replace Wi-Fi modems with transceivers equipped with LED lamps that could illuminate a room while both transmitting and receiving data. Life can help relieve the excessive loads that the present wireless system is experiencing by combining the new and underutilized capacity of visible light with the currently available radio frequencies for data transport [12].

### III. THE METHOD AND ONGC STATION

Instead of using traditional gate-valve control mechanism on compressed steam pumping, in this project as proposed solenoid valves can be replaced which will be unique choice for communicating under sea against under water pressure. These kind of solenoidal valves can be controlled via microcontrollers based on logical triggering voltage. In this proposal we put forward in two divisions as phase – I automatic Mode and phase – II on Manual Mode. Both the modes are secured via digital passwords to ensure Firewall safety system of the nation. Through google assistant voice engine, trigger phrase are created to control the gate mechanism of valves from any part of the world. On the other-hand this system can be manually operated through the resource person from the sub-station against emergency activation and de-activation of the entire system. This method is recently introduced in line with the newest technology as everything is beneath our palms. These IoT technologies area units developed over recent years. However, the instrumentation is within the subsea area unit quite previous from eighteenth centuries, and it is solely controlled from the highest facet victimisation fluid mechanics as a medium of communication.

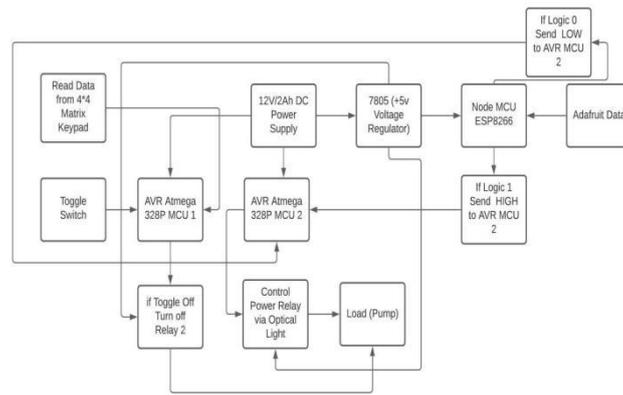


Fig 1 Block diagram

Therefore we've intercalary the automated part to form the method very little more leisurely to speak to subsea instrumentation from any a part of the planet. On victimisation MQTT broker (Message Queuing measurement Transport) that may be a network protocol that transfers data between devices, the protocol sometimes runs by receiving all the messages from the shopper then routing the message to the acceptable information science address solely. IFTTT (If this then that) it's associate application, web-based service that creates chains of an easy conditional statement. It's a cloud service that is primarily used for storing and retrieving applicable messages and directions. Node MCU may be a Wi-Fi module specially targeted for IoT primarily based applications.

**A. Node MCU:**

Is associate open supply IoT platform. It includes code that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware that is predicated on the ESP-12 module. The term "NodeMCU" by default refers to the code instead of the event kits. The code uses the Lua scripting language. it's supported the e Lua project and designed on the Espressif Non-OS SDK for ESP8266. It uses several ASCII text file comes, like lua-cjso and SPIFFS. The Node MCU (Node Micro Controller Unit) is associate open supply software system and hardware development setting that's designed around a really cheap System-on-a-Chip (SoC) known as the ESP8266. The ESP8266, designed and made by Espressif Systems, contains all crucial parts of the trendy computer: processor, RAM, networking (wifi), and even a contemporary software and SDK. Once purchased at bulk, the ESP8266 chip prices solely \$2 USD a chunk. That creates it a wonderful selection for IoT comes of every kind. However, as a chip, the ESP8266 is additionally arduous to access and use. You've got to solder wires, with the acceptable analogue voltage, to its PINs for the best tasks like powering it on or causation a keystroke to the "computer" on the chip. And, you've got to program it in low-level machine directions that may be understood by the chip hardware. Whereas this level of integration isn't a retardant once the ESP8266 is employed as associate embedded controller give factory-made physics, it's a large burden for hobbyists, hackers, or students UN agency need to experiment with it in their own IoT comes. Borrowing a page from the prosperous playbooks of Arduino or a Raspberry Pi, the Node MCU project aims to modify ESP8266 development.

**B. LCD DISPLAY** They use identical basic technology, except that absolute pictures area unit created from an outsized range of tiny pixels, whereas different displays have larger parts. LCDs will either be usually on (positive) or off (negative), counting on the polarizer arrangement. as an example, a personality positive liquid crystal display with a backlight can have black inscription on a background that's the color of the backlight, and a personality negative liquid crystal display can have a black background with the letters being of identical color because the backlight. Optical filters area unit intercalary to white on blue LCDs to relinquish them their characteristic look.

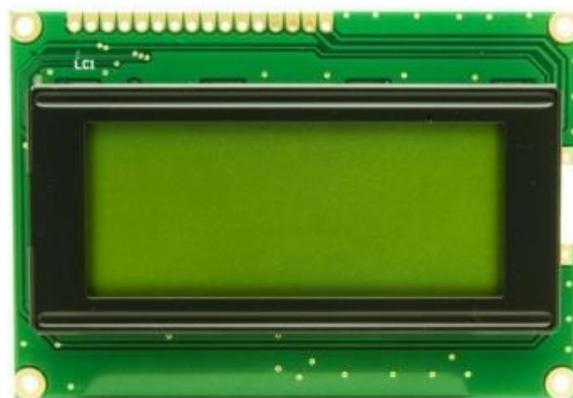


Fig.2. LCD display

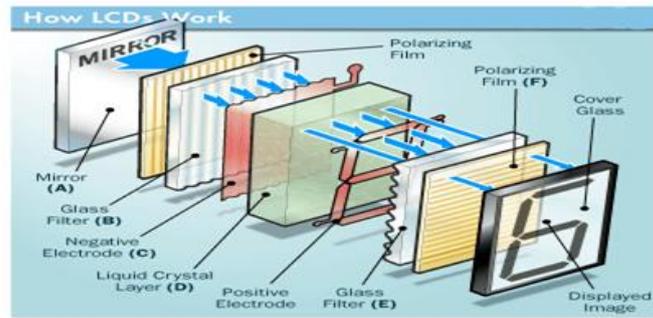
*C. LCD LAYER DIAGRAM:*

Fig.3. LCD LAYER DIAGRAM

Next involves the second piece of glass with associate conductor within the type of the parallelogram on very cheap and, on top, another polarizing film. It should be thought-about that each the items area unit unbroken at right angles. Once there's no current, the sunshine passes through the front of the liquid crystal display it'll be mirrored by the mirror and bounced back. Because the conductor is connected to a battery this from it'll cause the liquid crystals between the common-plane conductors and also the conductor formed sort of a parallelogram to straighten. Thus, the sunshine is blocked from passing through.

*D. SUBMERSIBLE PUMP:*

Fig.4. Submersible Pump

A submersible pump (also referred to as a sub pump or associate degree ESP) may be a device with a hermetically sealed motor that's tightly connected to the pump body. The full system is immersed within the pumped-up fluid. The key advantage of this sort of pump is that it eliminates pump cavitation that may be a downside caused by an outsized elevation distinction between the pump and therefore the fluid surface. Submersible pumps, as critical jet pumps, that turn out a vacuum and admit gas pressure, push fluid to the surface. Submersibles square measure used in significant oil applications exploitation quandary because the motive fluid, and that they use pressured fluid from the surface to drive a hydraulic engine down hole instead of an electrical motor. Electrical submersible pumps square measure period of time centrifugal pumps operational during a vertical position. Liquids, accelerated by the blade, lose their mechanical energy within the diffuser, wherever a conversion of kinetic to pressure energy takes place. This can be the most operational mechanism of radial and mixed flow pumps. In the HSP, the motor may be a hydraulic motor instead of associate degree electrical motor, and will be closed cycle (keeping the ability fluid cut loose the made fluid) or open cycle (mingling the ability fluid with the made fluid down hole, with surface separation). The pump shaft is connected to the gas setup or the defender by a mechanical coupling at very cheap of the pump. Fluids enter the pump through associate degree intake screen and square measure raised by the pump stages. Different components embody the radial bearings (bushings) distributed on the length of the shaft, providing radial support to the pump shaft. Associate degree ex gratia bearing takes up a part of the axial forces arising within the pump, however most of these forces square measure absorbed by the protector's bearing. There are screw-type submersible pumps, there's a steel screw that is employed as a operating component in them. The screw permits the pump to figure in water with high sand content and different mechanical impurities.

*E. Voltage Regulator:*

This circuit may be a little +5V power provides, that is beneficial once experimenting with digital physics. Those transformers square measure simply offered, however typically their voltage regulation is extremely poor, that makes them not terribly usable for digital circuit experimenter unless a stronger regulation are often achieved in how.

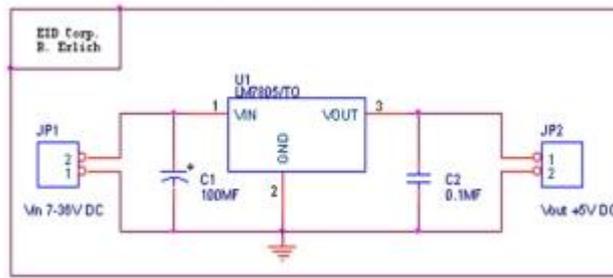


Fig.6. Circuit Diagram for Voltage Regulator

This circuit will offer +5V output at concerning one hundred fifty mA current, however it are often accrued to one A once sensible cooling is supplemental to 7805 regulator chip. The circuit has over overload and terminal protection.

#### IV. RESULTS

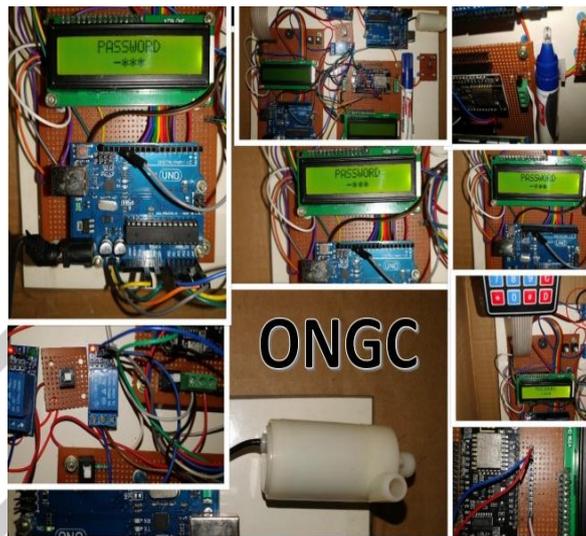


Fig.7. Output Snap 1

The column line is connected with the associate degree code of the ability provide through resistors and let the I/O port of MCU connected with the row line work as an output terminal. The I/O ports connected with the column line are the input.



Fig.8. Output Snap 2

Membrane data input device may be a quite presently widespread operation system within the world that has the benefits of each usefulness and wonder. It's composed of panel, higher circuit, isolation layer and bottom circuit.

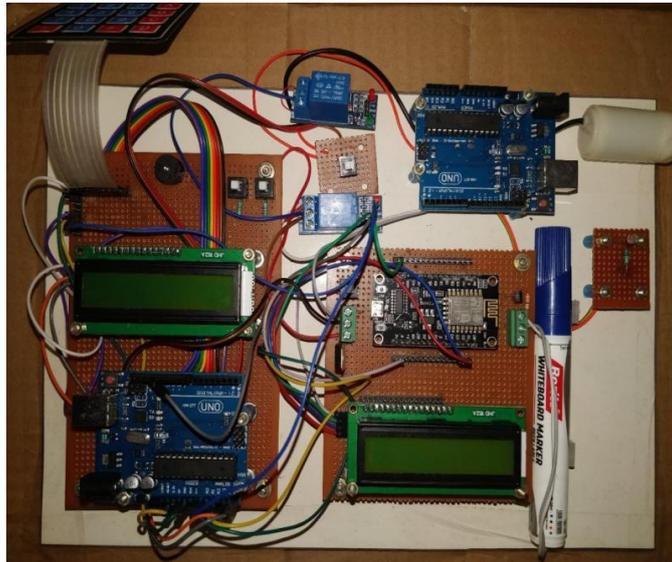


Fig.9. Output Snap 3

To overcome this downside, we are able to use the sunshine dependent electrical device circuit for dominant the masses supported the intensity of sunshine. Associate degree LDR or a photograph electrical device may be a device that is formed of high resistance semiconductor material.

## V. CONCLUSION:

Fiber optics communication in subsea - greener, cleaner, safer communication networks. Fiber communication in subsea is acting as a catalyst. As mentioned at the beginning of the presentation, this project objective is to develop subsea communication exploitation fiber optics and thus constant is developed and produces a hundred per cent outcome obviously. It'll manage the subsea instrumentality exploitation fiber optics at intervals few seconds. So, developing the time of communication in subsea directly scale backs the value involved at intervals the project. Moreover, the study on the ways that of exploitation this method in current subsea instrumentality square measure to be analysed and tested time period at intervals the sector. As already there's fiber cable gift in subsea point, there's a wonderful scope for the use and evolution of fiber communication technology in subsea.

The thought of fiber communication is account many as a result of its accessible and faster suggests that of transferring data. The optical communication system in subsea might become another resolution to ancient hydraulic Communication. The semi-permanent look seems to be wonderful for the Oil and gas trade because the downfall is close to complete. The device developed is dominant the subsea instrumentality at intervals microseconds with the assistance of optic fiber (wired) as a medium, in future wireless Communication in Subsea are often developed exploitation Li-Fi as a medium of communication.

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