UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FIBER OPTIC SENSOR FOR DIFFERENT CONCENTRATIONS DETECTION OF HONEY

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunications) with Honours

by

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I hereby, declared this report entitled “Honey Bee Concentration Detection Using Fiber Optic Component as Sensor Element” is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the faculty of engineering of UTEM as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

…….

(Project Supervisor)

ABSTRAK

Fiber optik sensor untuk mengesan madu lebah merupakan teknologi yang mengesan cecair menggunakan kabel gentian optik. Kajian ini untuk membangunkan sensor yang boleh mengesan parameter dalam cecair. Sensor ini telah ujian dalam 10 peratusan yang berbeza kepekatan iaitu dari 10% hingga 100% dan juga diuji dengan 4 panjang gelombang yang berbeza pada kepekatan madu lebah yang 850nm, 1300nm, 1310nm dan 1550nm. Sensor gentian optik tenggelam dalam kepekatan madu lebah dalam masa 1 jam dan data diambil setiap 5 minit. Akhirnya kepekatan madu lebah mempengaruhi reaksi sensor gentian optik.

ABSTRACT

Fiber optic sensors to detect honey bee is a technology that detects liquid using fiber-optic cables. This study was to develop a sensor that can detect the concentration of honey. These sensors were tested in 10 different percentage concentrations ranging of honey from 10% to 100% and also tested with four different wavelengths of fiber optic at 850nm, 1300nm, 1310nm and 1550nm. Optical fiber sensor is immersed in the concentration of honey in 1 hour and data is collected every 5 minutes. Finally honey concentration affects reaction to optical fiber sensor has analysed.

DEDICATION

To my beloved parents

To my kind lecturers

And not forgetting to all friends

For their

Love, Sacrifice, Encouragement, and Best Wishes.

ACKNOWLEDGMENTS

In completing this project, I have received a lot of helps from my supervisor, lecturers, researchers and family members and fellow friends.

Firstly, I want to give my upmost thanks to my supervisor, Mr. Md Ashadi bin Md Johari who gave me an opportunity to do this project for guiding and assisting me through the completion of this project. Without her guidance and persistent help, this project would not have been successful.

I would like to express deepest appreciation to my parents in supporting me mentally and financially, for their encouragements and supports.

Secondly, it is also my duty to record my thankfulness to my fellow friends that gave advice at some points and lent me a hand in completing the project. Also to a friend that offered this private space for field test and analysis of the prototype.

TABLE OF CONTENT

Abstrak i

Abstract ii

Dedication iii

Acknowledgments iv

Table of Content v

List of Table viii

List of Figures ix

List of Abbreviations, Symbols and Nomenclature x

CHAPTER 1 : INTRODUCTION 1

1.1 Introduction 1

1.2 Project Background. 1

1.3 Objective. 2

1.4 Problem Statement. 3

1.5 Scope Project. 3

CHAPTER 2: LITERATURE REVIEW 4

2.1 Introduction. 4

2.2 Fiber Optic. 4

2.2.1 Basic Structure of an Optical Fiber 5

2.2.2 Propagation Modes of Fiber Optic. 7

2.2.2.1 Single-mode Step Index. 8

2.2.2.2 Multi-mode Step Index. 9

2.2.2.3 Multi-mode Graded Index. 10

2.3Fiber Optic Sensor. 10

2.3.1Fiber optic sensor networks: Basic concepts. 11

2.4 Honey Bee 12

2.4.1Background of honey. 12
2.4.2 Types of honey. 13
2.4.3. Benefit of honey. 13
2.4.3.1 Healing wounds and burns. 13
2.4.3.2 Honey for treating allergies. 14
2.4.3.3 Fighting infections 14
2.4.3.4 Cold relief. 14
2.5 New Technology in Fiber Optic Sensor. 15

CHAPTER 3: METHODOLOGY 17
3.1Introduction. 17
3.2 Discussion with Supervisor. 17
3.3 Process of Cutting. 17
3.4 Process of Stripping 17
3.5 Process of Cleaving. 18
3.6 Process of Splicing. 19
3.6.1 Alignment. 20
3.6.2 Impurity Burn-Off. 20
3.6.3 Fusion. 20
3.7 Flow Chart for Process of Experiment. 22
3.8 Experiment Testing and Report Writing. 24

CHAPTER 4: RESULT & DISCUSSION 25
4.1 Introduction. 25
4.2. Design of Fiber Optic Sensor. 25
4.3 Fiber Optic Sensor Analysis For Honey Bee. 26
4.3.1 Analysis of 10% Concentration of honey bee. 26
4.3.2 Analysis of 20% Concentration of honey bee. 28
4.3.3 Analysis of 30% Concentration of honey bee. 30
4.3.4 Analysis of 40% Concentration of honey bee. 32

4.3.5 Analysis of 50% Concentration of honey bee. 34

4.3.6 Analysis of 60% Concentration of honey bee. 36

4.3.7Analysis of 70% Concentration of honey bee. 38

4.3.8 Analysis of 80% Concentration of honey bee. 40

4.3.9 Analysis of 90% Concentration of honey bee. 42

4.3.10 Analysis of 100% Concentration of honey bee. 44

4.4 Summary for the Best Selected Wave Length for Each Concentration of Honey Bee Based On Sensitivity. 46

CHAPTER 5: CONCLUSION & FUTURE WORK 48

5.1 Introduction. 48

5.2 Achievement of Objective. 48

5.3 Analysis. 48

5.4 Future Research Recommendation. 49

REFERENCES 50

APPENDICES 51

LIST OF TABLE

TABLE 4.1: ANALYSIS OF 10% CONCENTRATION OF HONEY BEE. 26
TABLE 4.2: ANALYSIS OF 20% CONCENTRATION OF HONEY BEE 28
TABLE 4.3: ANALYSIS OF 30% CONCENTRATION OF HONEY BEE. 30
TABLE 4.4: ANALYSIS OF 40% CONCENTRATION OF HONEY BEE. 32
TABLE 4.5: ANALYSIS OF 50% CONCENTRATION OF HONEY BEE. 34
TABLE 4.6: ANALYSIS OF 60% CONCENTRATION OF HONEY BEE. 36
TABLE 4.7: ANALYSIS OF 70% CONCENTRATION OF HONEY BEE. 38
TABLE 4.8: ANALYSIS OF 80% CONCENTRATION OF HONEY BEE. 40
TABLE 4.9: ANALYSIS OF 90% CONCENTRATION OF HONEY BEE. 42
TABLE 4.10: ANALYSIS OF 100% CONCENTRATION OF HONEY BEE. 44

LIST OF FIGURES

FIGURE 2.1: THREE MAIN SECTIONS OF FIBER OPTIC CABLE. 5
FIGURE 2.2: TYPES OF FIBER OPTICS CABLE. 6
FIGURE 2.3: BASIC STRUCTURE OF THE LOOSE BUFFER AND TIGHT BUFFER. 7
FIGURE 2.4: LOOSE BUFFER CABLE AND TIGHT BUFFER CABLE. 7
FIGURE 2.5: TYPE OF FIBER OPTIC. 8
FIGURE 2.6: FIBER OPTIC SINGLE MODE. 9
FIGURE 2.7: MULTI-MODE STEP INDEX. 10
FIGURE 2.8: MULTI-MODE GRADED INDEX 10
FIGURE 2.10: MULTIPLEXED AND DISTRIBUTED SENSORS. 12
FIGURE 3.1: THE MILLER STRIPPER USED TO STRIP THE FIBER OPTIC AND PIGTAILS CABLE 18
FIGURE 3.2: THE CUTTING (CLEAVING) THE FIBER OPTIC AND PIGTAILS CABLE 18
FIGURE 3.3: THE PROCESS OF JOINING FIBER OPTIC CABLE AND PIGTAIL CABLE BY FUSION SPLICING 19
FIGURE 3.4: THE RESULT OF FUSION SPLICING OF FIBER OPTIC CABLE AND PIGTAIL CABLE 21
FIGURE 3.5: THE STRIPPED MIDDLE PART OF THE FIBER OPTIC CABLE 21

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

ASE	-	Amplified Spontaneous Emission
ANOVA	-	Analysis of Variance
CATV	-	Cable TV
CCTV	-	Close Circuit TV
COD	-	Coefficient of Determination
DC	-	Digital Current
FMM	-	Federation of Malaysian Manufacturers
FOS	-	Fiber Optic Sensor
FOSS	-	Fiber Optic Sensing System
FOT	-	Fiber Optic Technology
FYP	-	Final Year Project
HCS	-	Hard Clad Silica
HU	-	Highly Used
IT	-	Information Technology
LAN	-	Local Area Network
LED	-	Light Emitting Diode
LU	-	Least Used
MU	-	Moderately Used
NA	-	Numerical Aperture
NU	-	Not Used

CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter, will covered background of the project title, objectives, problem statements faces, work scopes, project significant and the last the conclusion of the project.

1.2 Project Background.

The usage of optical fiber today are quite numerous. With the blast of information traffic appropriate to the Internet, electronic commerce, computer networks, multimedia, voice, data, and video, the need because of a transmission medium together with the bandwidth applications for handling such significant amounts of data is paramount. Fiber optics, with its comparatively infinite bandwidth, has confirmed to be the solution.

(Kist & Sohler, 1983) defines that a Fiber-Optic sensor (FOS) consists in fact about a light source, a fiber link and connectors, a detector, and a sensor element. This sensor factor might stay localized then disbursed and is uncovered to the light modulating as the measured or parameter on interest.

In spite of the fact that the most essential utilization of optical fibers is in the field of correspondence, optical fibers are discovering an ever increasing number of uses in the territory of detecting. The utilization of optical fibers for such applications offers an indistinguishable favourable circumstances from in the field of correspondence: lower cost, littler size, tough, higher exactness, more prominent adaptability with multifunctional abilities, extensive variety of sensor gage lengths, and more noteworthy unwavering quality. Contrasted with the customary electrical sensors, such fiber optic sensors are insusceptible to the outer electromagnetic impedance and can likewise be utilized as a part of risky and hazardous conditions.

Utilizing fiber optic sensors, it is conceivable to quantify any outside parameter, for example, weight, temperature, electric present, attractive field, turn, quickening, strain, and substance and organic parameters, with more noteworthy accuracy and speed. These preferences prompt to expanded reconciliation of such fiber optic sensors into such respectful structures as extensions and passages, prepare businesses, therapeutic instruments, air ships, rockets, and even autos.

Honey is a concentrated fluid that takes after syrup has a sweet taste. The sweet taste of the honey created normally by honey bees and creepy crawlies from blossom nectar. The substance of honey is commanded by sugar (79.8%) and water (17%). Available there are many instances of fake honey bringing about loss of normal sweetness of honey. To discover duplicating is typically done research facility test were regarded less compelling. In this review, making honey quality testing instruments utilizing optical sensors to decide characteristic honey or blend. Honey contains sugar that can play the plane of polarization so that when higher centralizations of sugar, the more removed the deviation point.

This project is focusing on how Honey Bee concentration detection by using Fiber Optic component as sensor element. With this study can help the field of agro technology identifies the purity of the honey bee by using an optical sensor. Besides it also can apply to study in various fields of optical fiber does not fall on a public communications such as the use of optics.

1.3 Objective.

The main objectives of this project:

1. To study and understand the usage of fiber optic sensor.
2. To develop fiber optic sensor for Honey in various concentration.
3. To analyse the performance of fiber optic sensor for Honey concentration.

1.4 Problem Statement.

As is commonly known that honey has many benefits for good health, such as mineral and vitamin in honey is needed by the body, Helps dissipate body heat, hoarse voice, educating the brain, and can moisten the throat, improve system digestion, good for beauty and makes the skin smoother and smoother (ageless), Regulating blood circulation, effective against the growth of adolescents and children normally, Increase immunity / energy and can prevent the flu, aim for women during pregnancy (six months upwards) and postpartum (20 days) and so on. Therefore, the optical fiber sensor is used to determine the purity of the honey because honey bees artificial dumping which is detrimental to the health of consumers. Artificial honey also contains a high sugar content and sugar content is not good for the body of the user. Honey bee natural sugar content beautiful and sweet honey that is original is not artificial sugar. Therefore the optical fiber sensor is one of a new medium to identify the concentration of the honey bee. With this project can also help the relevant authorities such as agro technology.

1.5 Scope Project.

The scope of this project is to develop a Honey Bee concentration detection using fiber optic component as sensor element. Besides that, the scope of this project is to analyse the performance of fiber optic sensor for Honey Bee concentration. This project will contribute greatly agro technology researchers to use the concentration of the honey bee. At last, yet vitally, the scope of this project is able to achieve the main objectives of this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction.

The characteristics and some information of the devices being used in the project are discussed in this chapter. The research topics that had been discussed in this chapter are basic structure of an optical fiber, fiber optic sensor, honey bee and new technology in fiber optic.

2.2 Fiber Optic.

Fiber optics is significant building obstructs in the media transmission foundation. In 1880 Alexander Graham Bell and his collaborator Charles Sumner Tainted made an initial move towards optical fiber correspondence, the Photo phone, at Bell's recently settled Volta Laboratory in Washington D.C. Initially created in the 1970s, fiber-optic correspondence frameworks have upset the broadcast communications industry and have assumed a noteworthy part in the appearance of the Information Age. The fiber optics transformation at America started in the mid-1980s. At that time frameworks worked at 90Mb/s. At this information rate, a solitary optical fiber could deal with around 1300 synchronous voice channels.

Today, frameworks normally work at 10 GB/s and past. On account of its points of interest over electrical transmission, optical filaments have to a great extent supplanted copper wire interchanges in center systems in the created world. As a development that changed the scene of worldwide interchanges, optical fiber has a future as brilliant as the floods of light it bars all through the world. Because of its similarity with different innovations, developing cost-viability, and about boundless transmission capacity, optical fiber has the ability to develop and adjust to future shopper requests for voice, information, and video ability. The development of the fiber optics industry in the course of recent years has been touchy. Investigators

expect that this industry will keep on growing at a gigantic rate well into the following decade and past.

2.2.1 Basic Structure of an Optical Fiber.

The standards and system of optical fiber in media communications could be extremely confounded if there no fundamental comprehension of optical fiber. Optical fiber link utilize smooth hair-thin strands of glass or plastic to transmit information as a beam of light and the link is about the breadth of a human hair. A fiber optic link is comprised of three principle areas. They are the core, cladding, and support covering. This is show in Figure 2.1. The core is at the center of the link and it is comprised of silica. It works as the light transmitting area of the fiber and go about as a limit layer for the link.

The cladding is made up of immaculate silica and it act like a guide for the light waves to go down the link. This segment is essential since light moves in waves and will shoot out of the center if this segment is not present. This cladding will in the end reflect once again into the center. With respect to cradle, it is at the center of these three layers. It is comprised of acrylic polymer. This cushion layer secures cladding and center against bright light and gives the link unbending nature. This cushion covering is likewise helpful to secure an information from electromagnetic impedance.

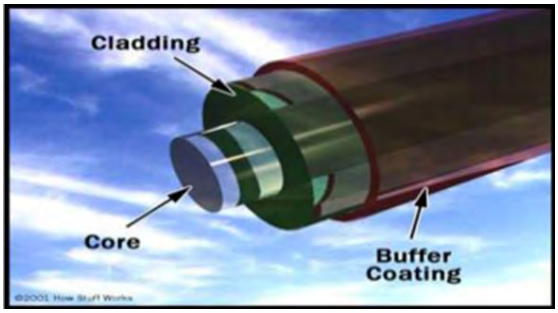

Figure 2.1: Three main sections of fiber optic cable.

The fundamental two sorts of optical filaments link in media communications arrange in light of their modular properties. They are single-mode fiber and multi-mode fiber. Single mode fiber optic link has a little

diametrical center that permits just a single method of light to proliferate. In light of this, the quantity of light reflections made as the light goes through the center reductions, bringing down lessening and making the capacity for the flag to travel speedier, advance.

Concerning multi-mode fiber, it has a significantly bigger center than single-mode fiber, permitting hundreds of signs to go through the fiber all the while. From it might appear that multi-mode filaments convey more data than single-mode strands, however as a general rule, single-mode can keep each light heartbeat over a more extended remove since its transmission of scattering or corruption is little, permitting it to have a higher data transmission. With the high transfer speed, the single-mode fiber is a perfect source of transmission medium for any applications and multi-mode just applies in the transmission removes inside two miles.

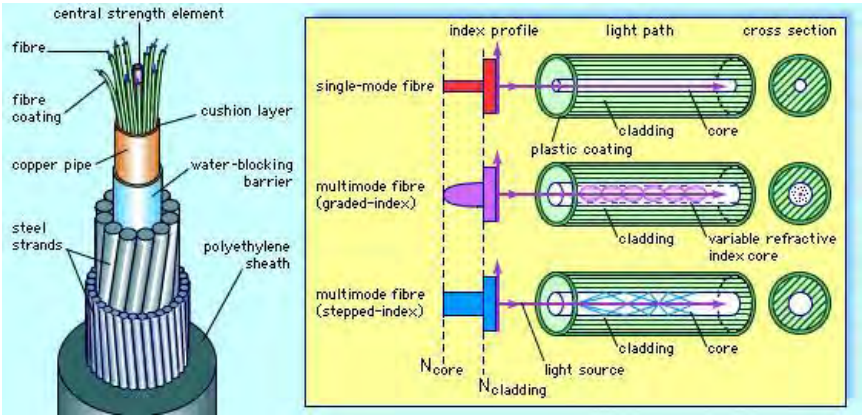

Figure 2.2: Types of fiber optics cable.

Link cushion has two sorts that are free support and tight cradle. The free cradle utilizes a hard plastic tube having an inside measurement a few circumstances that of the fiber. At least one strands exist in the support tube. The tubes detach the fiber from whatever is left of the link and the mechanical powers following up on it. The support turns into the heap bearing part. As the link extends and shrivels with changes in temperature, it doesn't influence the fiber to such an extent. A fiber has a lower temperature coefficient than most link components, implying that it grows and contracts less. Ordinarily, some abundance fiber is in the tube; as it were, the fiber in the tube is marginally longer than the tube itself. In this way, the link can undoubtedly extend and contract without focusing on the fiber. The tight cradle has a plastic straightforwardly connected over the fiber covering. This

development gives much better pulverize and effect resistance. It doesn't, be that as it may, shield the fiber too from the worries of temperature varieties. Since the plastic grows and contracts at an alternate rate than the fiber, developments created by varieties in temperature can bring about misfortune delivering microbends. Another preferred standpoint to the tight cradle is that it is more adaptable and permits more tightly turn radii. This favorable position can make tight-tube cradles valuable for indoor applications where temperature varieties are insignificant and the capacity to make tight turns inside dividers is wanted.

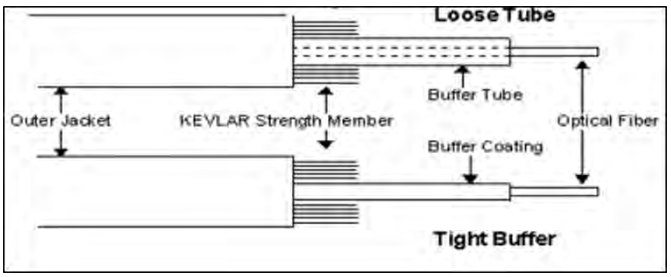

Figure 2.3: Basic Structure of the Loose Buffer and Tight Buffer.

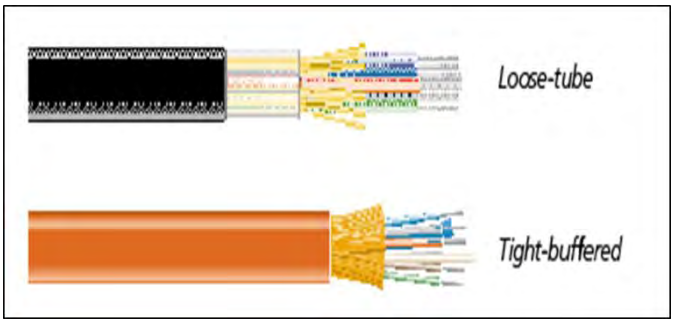

Figure 2.4: Loose Buffer Cable and Tight Buffer Cable.

2.2.2 Propagation Modes of Fiber Optic.

There are 2 sorts of proliferation mode in fiber optics link which are multi-mode and single-mode. These furnish diverse execution as for both weakening and time scattering. The single-mode fiber optic link gives the better execution at a higher cost.

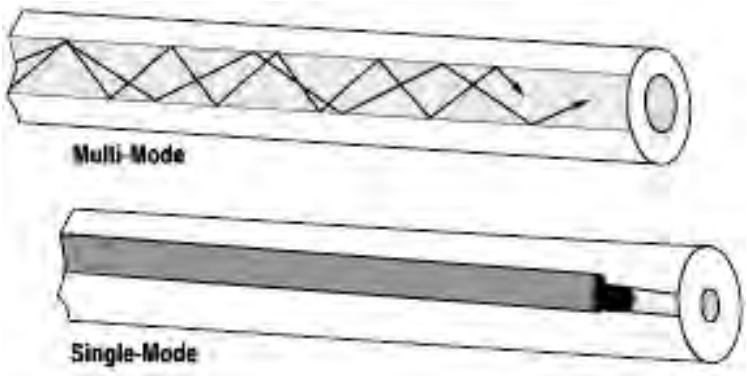

Figure 2.5: Type of fiber optic.

The quantity of modes in a fiber optic link relies on the measurements of the link and the variety of the lists of refraction of both center and cladding over the cross segment. There are three main conceivable outcomes which are multi-mode step list, single-mode step file and multi-mode reviewed list.

2.2.2.1 Single-mode Step Index.

The distance across of the center is genuinely little in respect to the cladding. Commonly, the cladding is ten circumstances thicker than the center. Looking at the yield beat and the information beat take note of that there is little weakening and time scattering.

Single mode proliferation exists just over a specific particular wavelength called the cutoff wavelength. Single-mode fiber optic link is manufactured from glass. Due to the thickness of the center, plastic can't be utilized to create single-mode fiber optic link.

Less time scattering obviously implies higher transfer speed and this is in the 50 to 100 GHz/km go. Not with standing, single mode fiber optic link is likewise the most expensive in the premises condition. Consequently, it has been utilized more with Wide Area Networks than with premises information interchanges. It is appealing more for connection lengths go as far as possible up to 100 km. In any case, single-mode fiber optic link has been getting expanded

consideration as Local Area Networks have been stretched out to more prominent separations over corporate grounds.

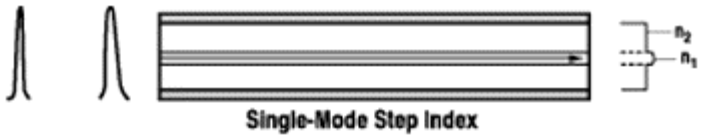

Figure 2.6: fiber optic single mode.

2.2.2.2 Multi-mode Step Index.

The width of the center is genuinely expansive with respect to the cladding. Take note of that the yield heartbeat is essentially constricted with respect to the information beat. It additionally endures critical time scattering. The higher request modes, the bobbing beams, tend to spill into the cladding as they proliferate down the fiber optic link. They lose some of their vitality into warmth. This outcomes in a weakened yield flag. Thusly, they don't all achieve the correct end of the fiber optic link in the meantime. At the point when the yield heartbeat is built from these different beam segments the outcome is time scattering.

Fiber optic link that shows multi-mode spread with a stage record profile is in this way portrayed as having higher constriction and additional time scattering than the other proliferation applicants have. Be that as it may, it is additionally the slightest exorbitant and in the premises condition the most broadly utilized. It is particularly alluring for connection lengths up to 5 km. For the most part, it has a center distance across that extents from 100 microns to 970 microns. It can be manufactured either from glass, plastic or PCS.

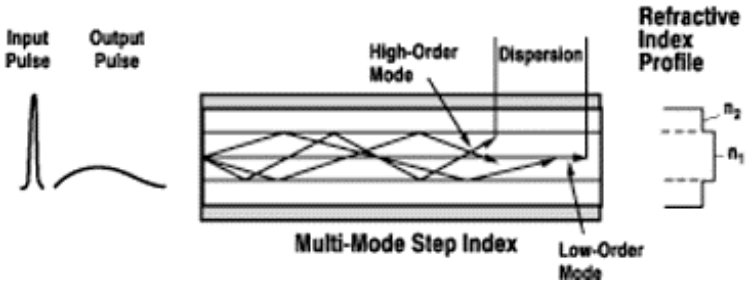

Figure 2.7: multi-mode step index.

2.2.2.3 Multi-mode Graded Index.

There is no sharp intermittence in the lists of refraction amongst center and cladding. The center here is significantly bigger than in the single-mode step file. When contrasting the yield beat and the info beat, take note of that there is some weakening and time scattering, yet not almost as awesome as with multi-mode step record fiber optic link.

Fiber optic link that displays multi-mode engendering with a reviewed list profile is consequently described as having weakening and time scattering properties somewhere close to the next two applicants. In like manner its cost is somewhere close to the next two competitors. This sort of fiber optic link is to a great degree well known in start information interchanges applications.

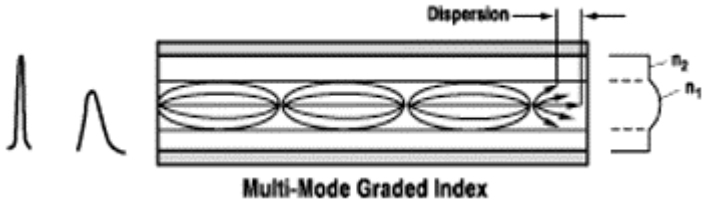

Figure 2.8: multi-mode graded index

2.3Fiber Optic Sensor.

The cost of a solitary channel fiber optic sensor is moderately high. Luckily, accumulation of the sensors brings about their cost lessening, given that it is conceivable to share either the wellspring of light, arrangement of recognition, or, ideally, both. Moreover, the most appropriate transmission medium for the signs created by the fiber sensors is likewise optical fiber, from which takes after that every one of the upsides of the fiber-based systems are additionally straightforwardly pertinent to the fiber optic sensor systems.

Multiplexing is the concurrent transmission of at least two data channels along a typical way. A fiber sensor framework incorporates three primary parts or