



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**FIBER OPTIC SENSOR DEVELOPEMENT FOR VEHICLE GEAR OIL
MONITORING PERFORMANCE USING MULTIMODE AND SINGLE
MODE FIBER.**

This report submitted in accordance with 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 “Fiber Optic Sensor Development For Vehicle Gear Oil Monitoring Performance Using Multimode And Single Mode Fiber.” 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 Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Electronic Telecommunication) with (Hons.). The member of the supervisory is as follow:

.....
(Mr. Md Ashadi Bin Md Johari)

ABSTRAK

Selama lebih dari 40 tahun yang lalu, penderia serat optik telah menjadi satu trend paling berjaya dan paling berkuasa untuk gentian optic dan juga teknologi untuk penderia. Beberapa kegunaan terawal gentian optik adalah untuk mengesan bahan kimia dan pengukuran. Bidang fiber optik penderiaan kimia telah berkembang untuk merangkumi pelbagai persekitaran pengukuran dan strategi anggaran. Sekarang ini, gentian optik membesar dengan cepat dan bertukar mikro atau teknologi nano untuk membuat sensor optik. Dengan prestasi lebih tinggi dan keserbabolehan, penggunaan ruang yang kecil juga ialah salah satu trend-trend semasa untuk penderia gentian optik. Projek ini untuk kepekaan penderia penganalisis gentian optik dalam prestasi minyak gear. Analisis ini mungkin berguna untuk kejuruteraan mekanikal untuk tujuan fungsi enjin.

ABSTRACT

For over 40 years ago, fiber optic sensor had become one of the most successful and most powerful application for fiber optic and also technology for sensor. Some of the earliest uses of optical fibers were for chemical detection and measurement. The field of fiber optic chemical sensing has grown to include a wide variety of measurement environments and estimation strategies. Nowadays, fiber optic was growing up rapidly and turns in micro or nano technology for making optic sensor. With higher performance and versatility, space utilization that is small also is one of the current trends for fiber optic sensor. This project is to monitor the performance of vehicle gear oil using fiber optic. This analysis may be useful for mechanical engineering for engine functional purpose.

DEDICATIONS

This humble effort specially dedicated to my beloved parents, family, lecturers and friends, whose love can never be forgotten for their support, guidance and encouragement upon completing this project and report.

Special dedicated to my mother

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CHAPTER 1

INTRODUCTION

1.1 Introduction

A fiber optic sensor is a detecting equipment that uses fiber optic innovation for measuring physical amounts, for example, temperature, weight, strain, voltages and acceleration. Fiber optics is the transmission of light through fiber beams of either glass or plastics. Furthermore, the light passes by procedure of inside reflection. The inside medium of the post or association is more sharp than the material including inside. This will makes the light continue to be reflected before going into the center where it can keep going down the fiber. Fiber optic cables are use for voice transmitting, pictures and other information at near the speed of light. Corning Glass examiners Robert Maurer, Donald Keck and Peter Schultz made fiber optic cables or "Optical Waveguide Fibers"equipped for passing on 65,000 conditions a greater number of data than copper cables, through which data passed on by an instance of light waves could be decoded even at a thousand miles away. Until today, the fiber optic have been commercialized from isolate phone utility to the Internet and restorative contraptions for instance the endoscope. Fiber optics are a bit of present day life.

Gear oils have improving for quite a long time, particularly in the elite high performance industry. Gear oil is a liquid lubricant utilized as a part of gearboxes for decrease of erosion by the working rigging and consumption security of the gear parts. It is likewise gets out a framework to

avert blockages, which can prompt lost increasing speed and engine hesitation.

In this project would help automotive industry as additional information for gear oil. This project is a development for vehicle gear oil monitoring performance using multimode and single mode fiber sensor. The main part is the functional of optical fiber in telecommunication system. The optical fiber can be used to detect the suitable temperature of gear oil.

1.2 Objectives

The main objectives of this project:

- a) To understand fiber optic sensor (FOS) operation.
- b) To develop fiber optic sensor (FOS) for Gear Oil detection using single mode and multimode fiber.
- c) To analyse performance of fiber optic sensor (FOS) using statistical method.

1.3 Problem Statement

Recently, the automotive industry has grown rapidly. There are many innovations that have been delivered to improve human life and easier. Gear oil is a lubricant made especially for shipment, exchange case, and differentiation in autos, trucks, and other machinery. There are many types of gear oils in the world. But users do not know which type is appropriate to use. Therefore, optical fiber sensors have been designed to prove the performance of gear oil and decide which types of light source suitable to use in industries. In this project there are three types of gear oils that are used as experimental materials which are Honda, Nissan and Perodua gear oil. The sensor will demonstrate result which gear oil reacts the best with fiber optic. Examination will be lead to decide the performance of fiber optic sensor (appropriate or not in gear oil application).

1.4 Scope

The scope of this project is to develop gear oil monitoring tool by using multimode and single mode fiber optic sensor. This project is to guarantee that the project is the correct way to accomplish its objectives. The scopes of the project are to study and develop the fiber optic sensor for gear oil. This new gear sensor oil would help automotive industry as additional information for engine system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This part will give the review from past research that have been carried out by the other researcher. Since the other paper has information that can be used and applied to this project, it should be referred carefully. The sources of literature review come from journal, thesis, references books and internet.

2.2 Fiber Optic

It took numerous years for the thoughts behind fiber optics to develop from customary optics. Indeed, even around then, individuals were considering making unique optical gadgets than of optical correspondences. Shape fundamental science, everybody realizes that light goes in straight lines. Despite the fact that focal points can twist light and mirrors can avoid it, light still goes in straight lines between the optical gadgets. Numerous developments have cropped up subsequently of this standard, for example, telescopes, magnifying lens and cameras. Be that as it may, there are times when light is expected to test inside corners that are not in straight lines. This issue emerged much sooner than the arrangement was found. The need to pipe light from place to put, for imparting, seeing, enlightening and different purposes prompted to the development of fiber optics.

A fiber optic is a network cable that uses glass (or plastic) string (strands) to transmit data. A fiber optic cable joins a bundle of glass strings, each of which is fit for transmitting messages adjusted onto light waves. In addition, fiber optic are utilized much of the time as a way to deal with transmit light between the two culminations of the fiber and find wide utilization in fiber optic correspondences where they allow transmission over longer segments and at higher trade speeds information rates than wire cable. Diverse with copper cable, fiber optic cable give greater exchange speed and can transmit data faster than other cables.

The working of optical fiber relies on upon essential properties of optics and the cooperation of light with matter. From a physical angle, light can be viewed as either electromagnetic waves or photons, which is a quantum of electromagnetic signal. This is a well-known wave molecule duality of material science. The most valuable point for optics frequently is to consider light as beams going in straight lines between optical components, which can reflect or bend(refract) them. Light is just a little piece of electromagnetic radiation. The way of all electromagnetic radiation is the same it can be seen as photons or waves and ventures and goes at the speed of light, which are 300,000 km/s. In the first place, most optical strands used transmit light in the adjacent infrared light at wavelengths of 800-1600 nm. The silica glasses used as a bit of most strands are clear at these wavelengths. Similarly, plastic filaments transmit best at distinguishable wavelengths be that as it may they are not as clear as those wavelengths as glass strands are in the infrared. Exceptional strands, which are presently being developed, are made of materials other than silica and can transmit light at longer infrared wavelengths. The most important things for any straight forward material is its refractive file (n). In optics, the refractive index is a dimensionless number that describe how light spread through that medium.

favourable position of single mode fiber is that once they are introduced, the framework's ability can be expanded as more current, high limit transmission framework gets to be distinctly accessible. This capacity saves the high cost of acquainting another transmission medium with get extended execution and allows financially keen increment from low confine structure as far as possible system. As the wavelength is widened, fiber optic passes on little modes until only single remains. After again, single mode operation begins when the wavelength approaches the middle broadness. At 1300 nm, the fiber allow only a single mode, it changes into a single mode fiber. As optical imperativeness in a single mode fiber goes in the cladding what's more inside. Besides the cladding must be more skilled transporter of energy. The estimation of the light appeared toward the aggregate of the single mode fiber is more capable than inside width since a segment of the optical energy of the mode goes in the cladding.

Multimode fiber, the first to be made and progressed, just essentially insinuates the way that diverse modes or light beams are brought in the meantime through the waveguide. In spite of the modes result from the way that light will just The fiber optic has an all-around more unmistakable focus width created of single mode fiber considering about the more essential number of modes and multimode fiber is less requesting than single mode optical fiber.

From the figure below, the fiber is called "Step Index" in light of the way that the refractive index changes all of a sudden from cladding to center. The cladding has a refractive index to some degree lower than the refractive index of inside glass. Step index multimode has a wide concentration, up to 100 microns in broadness. Along these lines, all beams inside a particular edge will be fully reflected at the middle cladding limit. Beam scattering the most remote point at concentrates more conspicuous than the