UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT A NEW GEAR OIL SENSOR USING FIBER OPTIC SENSOR FOR ENGINE FUNCTIONAL PURPOSE

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

by

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APPROVAL

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

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ABSTRAK

Selama 50 tahun yang lepas, penderia serat optik telah menjadi satu trend paling berjaya dan paling berkuasa untuk gentian optic dan juga teknologi untuk penderia. 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

In pass 50 years ago, fiber optic sensor had become one of the most successful and most powerful application for fiber optic and also technology for sensor. 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 for analyser sensor sensitivity fiber optic in gear oil performance. This analysis may be useful for mechanical engineering for engine functional purpose.

DEDICATION

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 family

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

dB	-	decibel
FOS	-	fiber optic sensor
EMI	-	electromagnetic interference
RFI	-	radio frequency interference
LED	-	Light Emitting Diode
Laser	-	Light Amplification by Stimulated Emission of Radiation
VCSEL	-	Vertical Cavity Surface Emitting Laser
PIN	-	Positive Intrinsic Negative
APD	-	avalanche photo Diode
EP	-	extreme pressure
FODS	-	fiber optic displacement sensors
TF	-	transmitting fiber
RF	-	receiving fiber
OSA	-	Optical Spectrum Analyzer
ASE	-	Amplified Spontaneous Emission
ISS	-	Interpolation Source Subtractions
nm	-	nanometer

km	-	kilometre
NA	-	numerical aperture

CHAPTER 1
INTRODUCTION

1.0 Project Background

Nowadays, fiber optic technology is use light to transmit data from one place to another. Since 1970s, the use of fiber optics has increased suddenly [Transition network, The Conversion Technology Experts]. Fiber optic has diameter that thicker than human hair is made by silica glass or plastic. Usually, fiber optic are used as a medium to transmit light between the two places and get wide use in fiber-optic communication, that it permitted to transmit over the long distance. Fiber optic signal is lesser amounts of loss rather than metal wires. Furthermore, problem from metal wires suffer excessively which is electromagnetic interference will be immune to fiber optic [John, 2009].

In addition, fiber optic sensor technology provides many different type of sensing like strain, temperature, pressure in harsh environment and remote locations. These sorts of sensors modulates a few elements of the light wave in an optical fiber such a power and stage or use optical fiber as a medium for transmitting the data information [Gholamzadeh and Nabovati, 2016].

Gear oil is grease made particularly for transmissions, exchange cases, and differentials in autos, trucks, and other hardware. It is of a higher consistency to better ensure the apparatuses and for the most part is connected with a solid sulphur smell.

This project is about improvement another apparatus oil sensor by utilizing fiber optic sensor for engine useful reason. This new apparatus oil sensor is to decide an actuation level of different sort's motor oil. This project would help mechanical industry as extra data for motor framework

1.1 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 in different concentration.
c) To analyse performance of fiber optic sensor (FOS) for concentration detection activity.

1.2 Problem Statement

In past few centuries, the mechanical industry was going up rapidly. There have much technology that has been produce to make human life better and easier. Gear oil is a lubricant made specifically for transmissions, transfer cases, and differentials in automobiles, trucks, and other machinery. Consumer does not know when the gear oil becomes concentrated and not able to function properly. At that time, the gear oil should be exchange due to the place of gear oil in the engine. Usually, they only depend on the expired dated that already fixed. Fiber optic sensor was developing to measure level of gear oil (condition of gear oil). The sensor will show result whether the gear oil still good to be applied. Analysis will be conduct to determine the performance of fiber optic sensor (suitable or not in gear oil application).

1.3 Scope of Project

The scope of this project is to study and develop fiber optic sensor for gear oil concentration detection from low concentration to high concentration. This project is to ensure that the project is in the right direction to achieve its objectives. The scopes of the project are to study and develop the fiber optic sensor for gear oil. This New Gear Sensor Oil Sensor would help mechanical industry as additional information for engine system.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter will give the review from previous research that have been done and related to this final year project. There are previous researches understanding on the fiber optic sensor, technique used in fiber optic sensor, role of gear oil and new technology that related to this project

2.1 Fiber Optics

Optical fiber is made out of a few components. The development of a fiber optic link comprises of a core, cladding, coating buffer, quality part and external coat. The optic centre is the light-conveying component at the inside. The centre is normally comprised of a mix of silica and germania. The cladding encompassing the centre is made of pure silica. The cladding has a marginally bring down record of refraction than the centre. The lower refractive list causes the light in the centre to reflect off the cladding and stay inside the centre [Transition network, The Conversion Technology Experts].

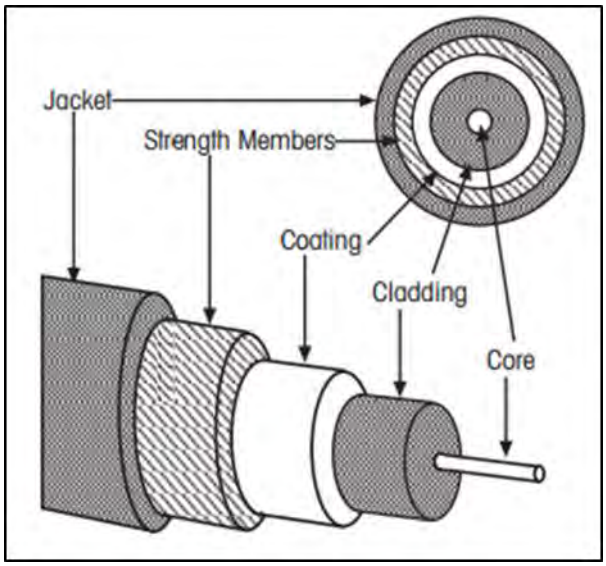

Figure 2.1: Fiber Optic Structure

The most important characteristic of a fiber is the attenuation degree that affected by purity and chemical composite of the glass core that use in fiber optic cable either single mode or multimode. For glass that high fluoride content, it important to improve fiber optic performance. That is because it transparent to almost the entire range of visible light frequency. This makes it valuable to multimode fiber that can transmit hundreds of discrete light wave signals [Richard, 1994].

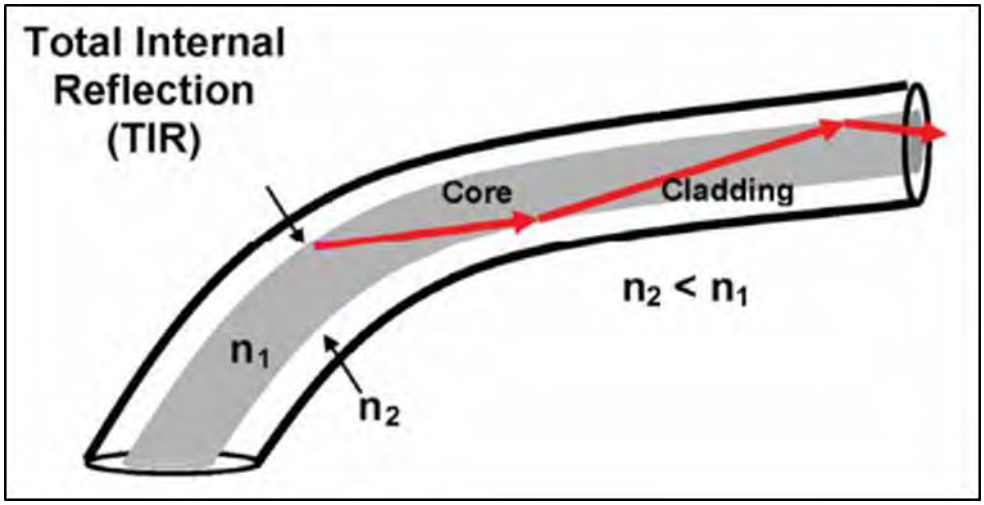

Figure 2.2: Total Internal Reflection

2.1.1 Type of Fiber Optic

Single mode fiber has a little center, making light go in a straight line and ordinarily has a contoured size of 8 or 10 microns. It has a boundless data transmission that can go unreported for more than 80 km, depending on the kind of transmitting equipment. Single mode fiber has a huge data limit, more than Multimode fiber [Transition network, The Conversion Technology Experts].

Multimode fiber support numerous ways of light and has a much bigger centre and has a centre size of 50 or 62.5 microns. The light goes down a much bigger way in multimode fiber, permitting the light to go down a few ways or modes [Transition network, The Conversion Technology Experts].

Multimode fiber can be divided in two ways which are step-index and graded index. Step-index fiber has a sudden change or venture between the index of refraction of the centre and the record of refraction of the cladding. Multimode step-index strands have lower data transmission than other fiber design [Transition network, The Conversion Technology Experts].

Graded index fiber was intended to cut down the modal dispersion occur in step index fiber. Modal dispersion inherent happens when light pass through the centre along high and low request modes. Graded index fiber is made up of numerous layers with the most elevated list of refraction at the centre [Transition network, The Conversion Technology Experts].

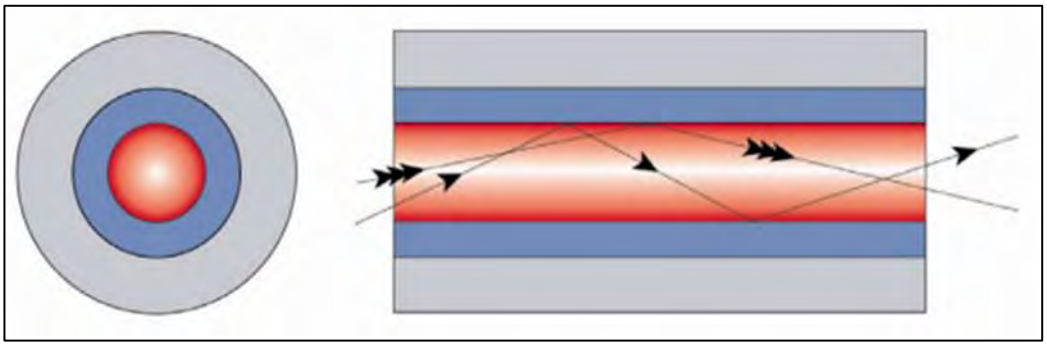

Figure 2.3: Multimode Fiber