UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Deveploment of brake oil monitoring system tool using application of Fiber Optic Liquid Sensor.

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Electronic 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 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)

ABSTRACT

Sejak 60 tahun yang lalu, sensor optik telah menjadi salah satu aplikasi yang paling berjaya dan paling berkuasa untuk kedua-dua serat optik dan juga teknologi untuk sensor. Pelbagai bidang aplikasi telah dikenalpasti dan teknologi kini telah matang ke titik di mana sistem sensor boleh didapati secara komersial dari beberapa syarikat. Selain itu, banyak lagi syarikat dan pertubuhan penyelidikan yang lain terlibat secara aktif dalam pengujian bidang sistem sensor prototaip. Objektif tesis ini adalah untuk memahami dan menganalisis operasi sensor optik serat. Kemudian, untuk menggunakan alat sistem pemantauan minyak brek dengan menggunakan serat Optik Cecair Optik. Seterusnya, untuk menganalisis prestasi gentian optik khas untuk mengesan keadaan minyak brek. Analisis ini mungkin berguna untuk teknologi dalam industri minyak dan gas.

ABSTRACT

Since 60 years ago, sensor optic had become one of the most successful and most powerful application for both optic fiber and also technology for sensor. A wide range of application areas have been identified and the technology has now matured to the point where the sensor systems are commercially available from a number of companies. Furthermore, many other companies and research establishments are actively involved in the field-testing of prototype sensors systems. The objective for this thesis is to understand and to analyse fiber optic sensor operation. Then, to deveploment of brake oil monitoring system tool using application of fiber Optic Liquid Sensor. Next, to analyze the performance of fiber optic specially for detecting the condition of brake oil. This analysis may be useful for technology in oil and gas industrial.

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CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

In the era of globalization, speed of data transmission is being concerned especially for engines and communication, where it helps human in their daily life. In addition, fiber has become communication medium of choice for cell phones, security cameras, medical, industrial network and everything that related with kind of communication. Utilizing optical fiber, there are several advantage which is, most cost effective in transporting information. It can transport more information longer distances in short period of time compared with other communication medium. Moreover, fiber optic is unaffected by the interference of electromagnetic radiation which makes it possible to transmit the information and data with less error and less noise.

In the previous 60 years, fiber-optical detecting has been a standout amongst the best and capable utilizations of both fiber optics and detecting innovation [Spillman, 2001]. Optical Fiber can be utilized as a medium for telecommunication and PC organizing on the grounds that it is adaptable and can be packaged as links. The use of fiber optics in this project is to expand the use of fiber optics in terms of the use of such sensors other than the data transmission. Therefore, from the fiber optic then modified into sensor and known as Fiber Optic Sensor(FOS). Fiber optic detecting is encouraged by its remarkable components, which make it conspicuous among other detecting strategies. These fiber optic sensors effectively meet the prerequisites like high affectability and speedy reaction in detecting distinctive concoction and physical variables. In the fiber optic detecting framework, the detected sign is insusceptible to electromagnetic obstruction (EMI) and radio recurrence impedance (RFI). Since optical strands offer low misfortune to the sign spreading through it we can utilize this strategy for remote detecting applications.

Furthermore, brake oil is a sort of water powered liquid utilized as a part of pressure driven brake and water powered grip applications in vehicles, cruisers and light trucks. It is utilized to move drive into weight, and to open up braking power. It works since oil are not obviously compressible in their normal express the segment atoms don't have inside voids and the particles pack together well, so mass strengths are specifically exchanged to pack the liquid's compound bonds.Brake liquid is subjected to high temperatures, particularly in the wheel chambers of drum brakes and plate brake calipers. It must have a high breaking point to abstain from vaporizing in the lines. This vaporization is an issue since vapor is exceptionally compressible with respect to fluid, and along these lines refutes the water powered exchange of braking power - so the brakes will neglect to stop the auto.

Finally,the development and usages of optical fibers have progressed rapidly starting late. The upsides of fiber optic sensors are adaptability from Electromagnetic Interference, wide information exchange limit, conservativeness, geometric versatility and economy. Overall, FOS is depicted by high affectability sensor when appeared differently in relation to various sorts of sensors.

1.2 OBJECTIVES

a) To understand fiber optic sensor (FOS) operation.
b) To develop fiber optic sensor (FOS) for Brake Oil detection in different type and condition.
c) To analyse performance of fiber optic sensor (FOS) for light sources detection activity.

1.3 PROBLEM STATEMENT

Fiber optic detecting innovation has advanced more than 60 years of improvement and commercialization. The fiber optic sensor has been connected in foundation, pipelines, prepare control, military, geothermal, oil and gas wells, and so forth. In this venture, the fiber optic sensor is utilized to recognize its execution and affectability on brake oils. Brake oil is grease made especially for transmissions, trade cases, and differentials in autos, trucks, and different materials. Soften oils is spent motor operation. Along these lines, consumer does not know when the break oil is terminated.

The issue happen in our reality is shopper do not know when the brake oil end up being high focus and ought to be exchange on account of the spot of brake oil in the motor. For the most part, buyer thoroughly relies on upon terminated date expressed on the container mark that has been adjusted by industrialist. This project is to ensure the performance and decide which of 8 type light sources suitable to use in industries by using 3 type of brake oil as a medium.

1.4 SCOPE OF WORK

The scope of this project is to complete the goal of the objective ,based on the scope has been outlined. In first semester ,literature review and methodology has been incorporated which more related about the project research and concept of fiber optic sensor .Next, for second semester will focus on experiment result and discussion.

The scope of study includes:

1. Develop fiber optic sensor for brake oil temperature detection which focus recognition from low temperature to high temperature.
2. Guarantee that the task is in the right heading to accomplish its goals.
3. Understanding the effects of the use of brake oil on fiber optic

1.5 THESIS OUTLINE

The thesis outline is dividing into two parts which are Final Year Project I and Final Year Project II. The outline as follows:

a) Final Year Project I Report

The introduction is briefly discussed in chapter 1.In this chapter, the background of the research such as objective, problem statement and project scope are mentioned. Chapter 2 is about literature view from previous research concerning on fiber optic. The methodology and procedures applied for this study are explained details in Chapter 3.

b) Final Year Project II Report

Chapter 4 presents about result and discussion for this project. In this chapter, the result will be explained to prove the best concentration of petrol oil that give the best performance and sensitivity level on fiber optic sensor. Finally, the conclusion of this study and recommendation are summarized in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

1.6 INTRODUCTION

This chapter presents about literature review and explains about the most fiber optic put consideration into the design and the type of analysis performed on structure. It includes the design and analysis of fiber optic sensor applications for brake oil test. Before design the fiber optic sensor for break oil, temperature detection and optimization, it is important to understand the concept of fiber optic and how it works. The concept of fiber optic is described in more detail. The sources of literature review come from journal, thesis, references books and internet. This parts also consists of components should be taken into consideration into and to be made as reference or studies for further project improvement.

1.7 FIBER OPTIC

In Figure 2.1 illustrate about fiber optic and refer to the innovation of transmitting light down thin strands of highly transperent optical fibers, normally glass but sometimes plastic. Fiber optics is utilized as a part of communication, lighting, medicine,automative, optical investigations and to make sensors. A fiber optic correspondence means sending signals starting with one area then onto the next as adjusted light guided through hair-thin filaments of glass or plastic. These signals can be analog or digital, video, data or voice. Fiber can transport more information longer distances in less time than any copper wire or wireless method. It is powerful and very fast-offering more bandwidth capability than any other form of communication. [Hayes J.,2009]

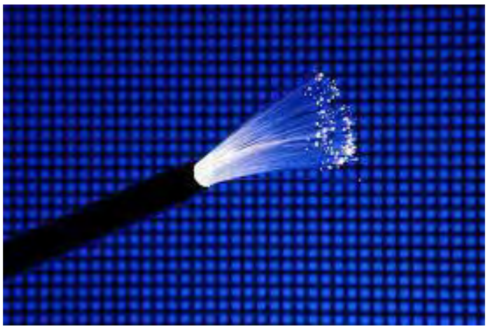

Figure 2.2a: Fiber Optic

Next, an important aspect of a fiber optic correspondence is that of extension of the fiber optic cables such that the losses brought about by joining two different cables is kept to a minimum. Joining lengths of optical fiber regularly turns out to be more complex than joining electrical wire or cables and includes cautious cleaving of the fibers, perfect alignment of the fiber cores, and the splicing of these aligned fiber cores. For applications that demand permanent connection a mechanical splice which holds the ends of the fibers together mechanically could be utilized or a combination join that utilizations warmth to intertwine the finishes of the strands together could be utilized. Temporary or semi-permanent associations are made by method for specific optical fiber connectors. , (Chriss Woodford, 2016)

Optical fiber is also used extensively for transmission of data. Multinational firms need secured, reliable systems to transfer data and financial information between buildings to the desktop terminals or computers and to transfer data around the world. Cable television companies also use fiber for delivery of digital video and data services. The high bandwidth provided by fiber makes it the perfect choice for transmitting broadband signals, such as high-definition television (HDTV) telecasts.

Furthermore, carriers use optical fiber to carry plain old telephone service (POTS) across their nationwide networks. Local exchange carriers (LECs) use fiber to carry this same service between centre of office switches at local levels, and sometimes as far as the neighbour or individual home (fiber to the home [FTTH]). [Hayes J.,2009]

1.7.1 HOW FIBER OPTICS WORKS

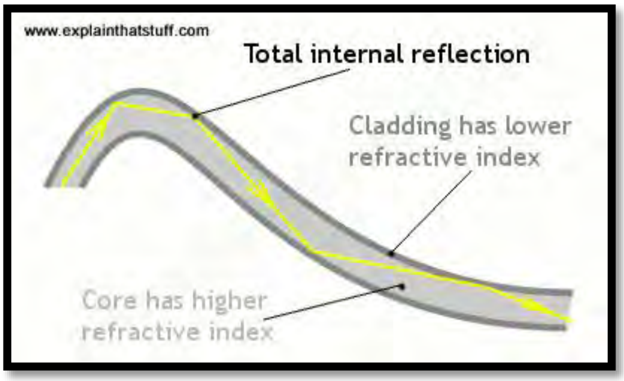

Figure 2.2.1a : Sum of inner reflection holds light beams bouncing down within a fiber-optic cable.

Based on figure above, there are show how the light travels through a fiber optic cable by bouncing repeatedly off the walls. Next, a beam of light, traveling in a glass pipe, simply to leak out of the edges, but if light hits glass at a truly shallow point under 42 degrees, it reflects back in again—as though the glass were really a mirror. This phenomenon is called total internal reflection. It's one of the things that keep light inside the pipe. , (Chriss Woodford, 2016)

The other thing that keeps light in the pipe is the structure of the cable, which is made up of two separate parts. The priority part of the cable in the middle is called the core and that's the bit the light travels through. Wrapped around the outside of the core is another layer of glass called the cladding. The cladding's job is to keep the light signals inside the core. It can did this because it is made of a different type of glass to the core. More technically, the cladding has a lower refractive index , (Chriss Woodford, 2016)

1.7.2 FIBER OPTIC CABLE CONSTRUCTION

Figure 2.1.2.a below demonstrated the fiber optic cable development. There are several of materials that utilizing as a part of components in fiber optic, for example, cable jacket, strengthening fibers, coating, cladding and core. Every components in fiber optic cable has its own capacity. A cable coat is the external layer of any cable. Most fiber optical links have an orange jacket although some types of jacket can have black or yellow in colour. , (Chriss Woodford, 2016)

Next, , strengthening fibres help protect the core against crushing forces. Coating is a layer of plastic that surrounds the core and cladding to strengthen and secure the fiber core. At that point, for cladding it is a thin layer that surrounds the core itself and serves in as a limit that contains the light waves and causes the refraction, enabling data to travel throughout the length of the fiber segment. Finally, the core is the physical medium that transports optical information signals from a connected light source to a receiving device. The core is a single continuous strand of glass or plastic that is measured in micron (µ) by the size of its outer diameter. The larger the core, the more light the cable can carry. , (Chriss Woodford, 2016)

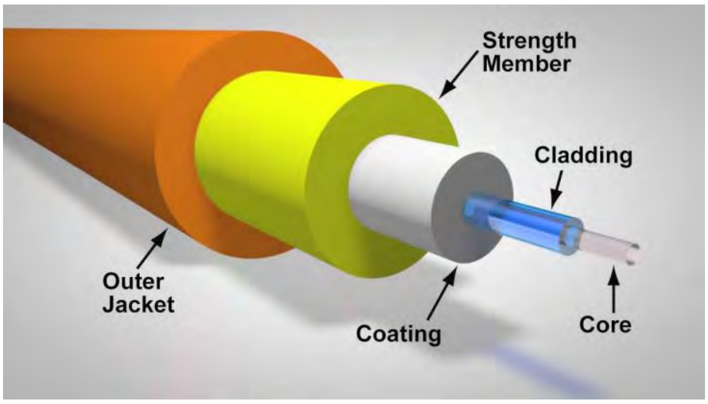

Figure 2.2.2.a: Fiber Optic Cable Construction

1.7.3 TYPE OF FIBER OPTIC

There are two basic type of fiber which are; multimode fiber and single-mode fiber. Multimode fiber is the most best intended for short transmission distances only and it is suited for use in LAN framework and videosurveillance. Single-mode fiber is best designed for longer transmision distances, making it appropriate for long-distance communication and multichannel transmission frameworks.

1.7.3.1 MULTIMODE FIBER

Multi-mode optical fiber is a type of optical fiber for the most part utilized for communication over short distance, for example, inside a building or under a grounds. Typical multi-mode cable have information rates of 10 Mbit/s to 10 Gbit/s over connection lengths of up to 600 meters (2000 feet). Multi-mode fiber has a fairly large core diameter that empowers various light modes to be propagated and limits the maimum length of a transmission interface because of modal dispersion.Besides,based on application nowaday,the equipment used for communications over multimodes optic fiber is less expensive than the single modes optical fiber.Therefore the multimodes optical fiber are used as a backbone applications in buildeing. The core of step index multimode fiber is made completely of one types of optical material and the cladding is another type with different optical characteristics. It has higher attenuation and is too slow for many uses, due to the dispersion caused by the different path lengths of the various modes travelling in the core.

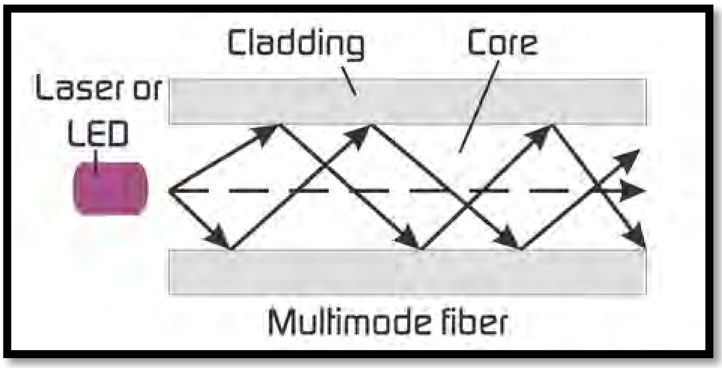

Figure 2.2.3.1a : Total internal reflection keeps light rays bouncing down the inside of a fiber-optic cable.

1.7.3.2 SINGLE MODE FIBER

Single modes fiber are uses as specific light wavelength. The cable's core diameter is 8 to 10 micrometres. Single-mode fiber is often used for intercity telephone trunks and video applications.

Single mode fiber has a much smaller core compared to multimode mode fiber (about 9 microns) , so that the light travels in only one ray (mode). It is used for telephony and CATV with laser sources at 1310 and 1550 nm because it has lower loss and virtually infinite bandwidth. Single mode fiber is use for outside plant networks such as telco, CATV, municipal networks and long data links such as utility grid management. [Hayes J., 2009]

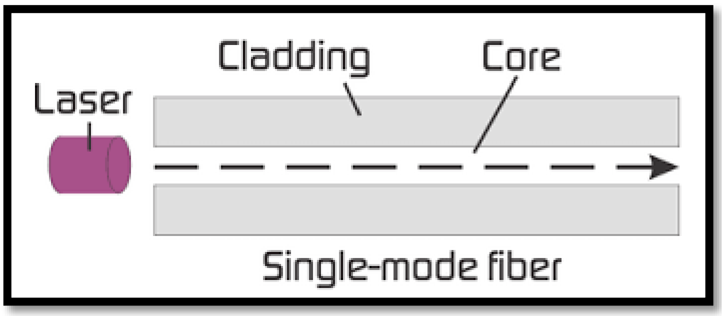

Figure 2.2.3.2a : Total internal reflection keeps light rays bouncing down the inside of a fiber-optic cable.