UNIVERSITI TEKNIKAL MALAYSIA MELAKA

OPTIMIZATION OF FIBER OPTIC ACETONE SENSOR BY USING TAGUCHI METHOD FOR DIABETICS

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronic Engineering Technology (Telecommunication) with Honours

by

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SESI PENGAJIAN: **2016/2017 Semester 1**

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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 Electrical Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

....

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ABSTRAK

Tujuan projek ini dijalankan adalah untuk membantu mengesan simptom penyakit kencing manis dengan menganalisis kepekatan aseton didalam air kencing pesakit dan proses pernafasan juga adalah satu cara untuk menganalisis pesakit kencing manis didalam jangka masa yang singkat. Disamping itu juga, projek ini menggunakan dua kaedah iaitu Kejuruteraan dan Matematik dimana kaedah kejuruteraan untuk menganalisis sensor gentian optik terhadap cecair aseton mengikut masa yang ditetapkan manakala dengan kaedah Taguchi yang menggunakan perisian Minitab adalah untuk menganalisis data yang diambil daripada kaedah kejuruteraan. Fiber optik adalah teknologi telah terbukti sebagai sensor cecair yang baik. Ia juga boleh menggantikan gentian optic dengan sensor peranti lain. Sensor gentian optik boleh mengukur perbezaan parameter seperti cecair, kimia, suhu dan sebagainya. Untuk bahagian ini sensor aseton telah digunakan untuk mengukur parameter yang diberikan seperti jenis kabel, jenis sumber yang diterima, masa dan penumpuan. Walau bagaimanapun kajian ini adalah untuk menganalisis prestasi sensor gentian optik dalam menentukan sensor aseton menggunakan kaedah taguchi untuk kencing manis.

ABSTRACT

The purpose for this thesis is to detect symptoms of diabetics by analyzing the concentration of acetone in the urine of patients and the respiration process also is a way to analyze diabetic patients in a short period. In addition, the project is using two methods, namely, Engineering and Mathematics where engineering methods to analyze the optical fiber sensor of the liquid acetone in a timely manner while the Taguchi method using Minitab software to analyze the data obtained from engineering methods. Fiber optics is the technology has been proven as a good liquid sensor. It also can replace the fiber optic sensor with other devices. Optical fiber sensor can measure different parameters such as liquids, chemicals, temperature and others. For this part of acetone sensor was used to measure the given parameters such as the type of cable, the type of resource that is received, time and concentration. However this study to analyze the performances of fiber optic sensor by determining sensor acetone using Taguchi methods for diabetes.

DEDICATION

This humble effort especially dedicated to my beloved parent, husband, family, lecturers and friends whose love can never be forgotten for their support, guidance and encouragement upon completing this projects and report. Thank you

ACKNOWLEDGEMENT

In the name of Allah S.W.T, the Most Gracious who has given me the strength and ability to complete this projects . Praise to Him who seek help and guidance and under His benevolence we exist and without His help, this project could not have been accomplished.

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Last but not least also dedicated to my classmates, friends, academic staffs, technical staffs and every person who is participated in helping me during the process of completing this project. The guidance and support they gave to me to overcome the obstacles encountered during completing this project.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

DOE	-	Design of Experiment
FBG	-	Fiber Bragg Gratting
FOC	-	Fiber Optic Cable
FOS	-	Fiber Optic Sensor
FO-SPR	-	Fiber Optic Plasmon Resonance Sensor
FSP	-	Flame Spray Pyrolysis
LED	-	Light Emitting Diode
MMF	-	Multi mode Fiber
OCT	-	Optical Coherent Tomography
OFS	-	Optical Fiber Sensor
OTDR	-	Optical Time Domain Reflectometer
POF	-	Plastic Optical Fiber
PPM	-	Part Per Million
PPT	-	Part Per Trillion
SEM	-	Scan to the Electron Microscopy
S/N	-	Signal Noise Ratio
VOC	-	Volatile Organic Compound
$>$	-	More than
σ	-	Stress
ϵ	-	Strain
$\%$	-	Percentage (100%)

CHAPTER 1
INTRODUCTION

1.0   Introduction

The first chapter on this research which is responsible to give a general explanation regarding the purpose of this research. In this chapter, it will give an overviews about the title for this project research, history of the research that had done before, the problem statements, the objectives and the scope of this study for this research. The overview will only be general information and the details for this research are discussed in other chapter. As indicated by (K.S Thyagarajan, 2007), an adaptable and straightforward fiber which made of from top notch expelled glass or plastic that works at higher transfer speed (information rate) than any type of correspondence and in addition grants transmission over longer separations is called fiber optic. Fiber optic is the innovation that assumes a vital part in current electronic telecom framework. Other than that, the rule of fiber optic is likewise connected and utilized as a part of differing present day bio-therapeutic electronic field.

A sensor that make the utilizations optical fiber either as the detecting components ("intrinsic sensors"), or as a technique for handing-off sign from a remote sensor to the gadgets that procedure the sign ("outward sensors") is known as Fiber Optic Sensor (F.O.S). Fiber Optic has numerous utilizations in remote detecting. Contingent upon the applications, fiber optic may well be utilized in light of its tiny sizes or in light of the very fact which an electrical force is needed at the remote area is not used, or on the ground seeing that

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numerous sensing element could be multiplexed at the fiber via each sensors. Time deferral may be resolved using a system, as an example, an optical time domain reflectometer (OTDR) and wavelength motion may be figure by using utilising an instruments actualizing optical recurrence area reflectometry.

Fiber optic sensor (F.O.S) are insusceptible to an electromagnetic impedance, and do not direct strength so that they may be utilized as a part of spot wherein there is high voltage electricity or flamable substances, instance, for the plane fuel. Fiber optic sensor may be meant to withstands high temperature too. Optical strands is utilised advertising sensor to quantify stress, temperature, weight and completely special quantities by means of altering a fiber so the quantity to be measured regulates the pressure, stage, polarization, and wavelength or term of mild within the fiber. Sensors that change the strength of light are the least complex, due to the fact surely a honest source and indicator are required. an mainly for treasured components of natural fibre optic sensors is which can, if wanted, gives the appropriated detection over big separation.Fiber optic sensor frameworks are without similarly ado utilized as a part of brutal mechanical conditions for the estimation weight, temperature, differential weights, stress, function, vibration also increasing speed. The big specialized favourable occasions of fiber optic transducers comprise little length, natural protection, insusceptibility to EMI and ceaseless use at temperature as much as a thousand°F. (Needham, 2010)

Acetone (systematically named propan-2-one) is that the compound with method (CH3)2CO. It's a colourless, flammable, volatile liquid and is that the great ketone. ketone is miscible with water and furthermore is a vital solvent in its very own right, generally the use of for cleansing motive inside the laboratory. approximately 6.7 million tonnes were made international in 2010, often for use as a solvent and manufacturing of methyl methacrylate and bisphenol A. it's miles a common constructing block in natural chemistry.

acquainted family uses of acetone are the energetic element in nail polish remover and as paint thinner.

Acetone is added and furthermore discarded within the human our our bodies via standard metabolism tactics. It's commonly gift in bloods and urine. people with diabetes produces it in large sums. diabetes is an unpredictabled leave out accrued with the diseases with an assortment of reasons. individual with diabetes have excessive blood glucoses that in addition referred to as excessive glucose or hyperglycemia.

In the event that the diabetes is not being overseen correctly, there isn't sufficient operating insulin to deliver glucose in your body's cells that need it. Denied of glucose, its primary gas source so your body will dispatch proper into a reinforcement arrangement: blazing fat for power. The breakdown outcomes of the technique, referred to as ketones can aggregate for your blood and in the long run in your pee. One kind of ketone is known as as acetone or CH3)2CO, has an obvious "fruity" smell; in case you're making ketones, you'll likely have fruity-noticing breath. (due to the reality that acetone is a key fixing in nail shine remover, it can all the more precisely be known as "nail shine remover breath").

An ordinary kingdom of ketones is a observe signal that your diabetes isn't below great manipulate. If now not handled right now with insulin, the ketone increase can broaden to an volatile condition called diabetic ketoacidosis or maybe diabetic trance kingdom. Your diabetes care association ought to incorporate policies for checking your ketones each by way of checking out your blood for ketones or dunking a check strip in your urine. The nearness and the significance of acetone and its digestion gadget in diabetic ketoacidosis ought to a first-rate extent been unnoticed. The grouping of acetone in plasma, urine and the expenses of acetone era and disposal in breath and pee were resolved and the costs of vivo digestion system had been figured.

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1.1 Problem Statement

On this modern-day age, diabetes has being one of the direst final results imaginable which leads in the direction of a stressing human's wellbeing. Diabetes is a gathering of metabolic maladies in which there are excessive glucose level over not on time length. The traditional diabetes this is all blood check diabetes consist of drawing blood at a social insurance provider's place of work or workplace and sending the specimen to laboratory for investigation. laboratory investigation of blood is expected to ensure check effects are unique. glucose measuring devices utilised as part of a medicinal offerings supplier's place of work, like finger-stick gadgets aren't sufficiently specific for locating however alternatively may also be utilised as fast marker of high bloods glucose (Anon,. n.d.). This wellknown strategy is taken a commonly long term to get the result. Advances expert and doctors to renowned diabetes' facet effect with the aid of breaking down the convergence of acetone from human's pee and breath technique is any other approach to observe the diabetes in an exceptionally fairly temporary duration. this sort of investigate testing for diabetic is to redesign from normal process. atypical nation acetone from check demonstrates that the patients can be determined to possess diabetes. The notice of breath acetone has been decided to correlate with the β-hydroxybutyrate awareness of blood in fasting fat affected person. in a unmarried day speedy degree of every breath acetone and blood-sugar were measured in 251 diabetic, as soon as the patients were grouped for analysis through the shape of diabetic control and consequently the fasting blood-sugar discovered .(Dept. of medication, n.d). The main problem is to investigate the diabetes which used to identify stage glucose in blood isn't constant and the hardware to test the diabetes persistent (Galcometer) is costly. There is need the machine to distinguish the diabetes with continual soundness and actual trying out result. Optical fiber as a sensor assist surgeons to perceive the diabetes' in patient bodies as a faster transmission and excessive affectability by using fiber optic sensor to apprehend the convergence of acetone.

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1.2   Objectives

The objectives of this project are to:

i.   To study and develop Fiber Optic Sensor (F.O.S) for acetone concentration detection

ii. To identify a significant effect of Fiber Optic Sensor (F.O.S) parameter on diabetic by using Taguchi method.

iii. To determine the optimal Fiber Optic Sensor (F.O.S) parameter.

1.3   Scopes

Before new technology or technique is applied, the system must be tested so that the performance of the design and analysis can be known. However, for any project to be done, the limitation of the scope of work must be very realistic and applicable. On the way to acquire the goal of study, the subsequent have been define as follows:

i.   Study on the correlation of diabetic and acetone in human's breath, in urine and blood testing

ii. Analyze the fiber optic sensor capability

iii. Design and develop the fiber optic sensor to detect the concentration of acetone

iv. Applying the various acetone concentration and obtain the result required which are closed to the theoretical result

v.   Analyze the data obtained, select the data that have optimum results and report writing

1.4 Expected Result

The project will be cover on the research that divided into two part. For the first part is an engineering part such as how to made a fiber. For example, cutting the fiber, splicing and do testing . Then second part is Design of Experiment (D.O.E) which is taguchi method 2 level orthogonal array. In this part, I have to figure out how to investigate table and run data in Minitab Software. In this anticipate research, in view of perception and examination, the outcome that normal is to detect the concentration of Fiber Optic Acetone Sensor for diabetic by utilizing Taguchi Method.
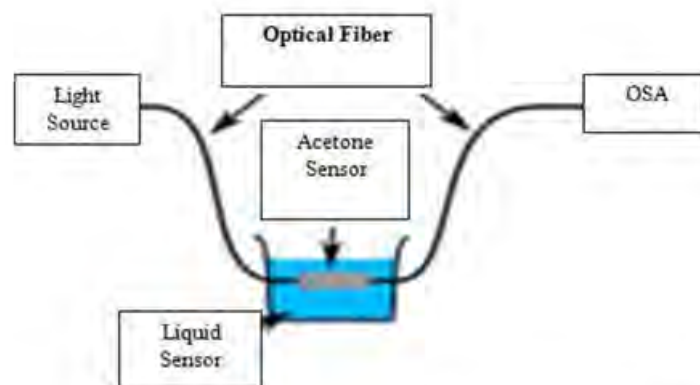

Figure 1.4: Drawing of the Fiber Optic Sensor for Testing Acetone Concentration

The design was sketch for projects of fiber optic sensors. The design is obtained from the discussion with supervisor after review the journals and articles. This design will used to do the whole projects. The expected result for this project is to create a fiber optic sensor which can detect the concentration of aceton

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CHAPTER 2
LITERATURE REVIEW

2.0   Introduction

In this chapter, the research has been done by other person which are related with the research that we were discussed. The facts from their research were used to guide this research in correct way. The sources came from the journal or article wrote by means of the preceding researchers which is associated with this experiments. Their theories and result assist this studies as they may be a evaluation between this studies and their researches .

2.1   Fiber Optic

Fiber Optic generation is simply use the mild to transmits records. the general uses of fiber optic did no longer begin till the 1970s. Robert Maurer of Corning Glass Works superior a fiber with a lack of 20 dB/km, promoting the economic use of fibers. for the cause that that point the usage of fiber optics is improved dramatically. Advances in fiber technology, decrease productions rate and installations have all contributed to the large use the fibers.

Normal with (Chris Woodford, 2016) an optical fibre can be a flexible, optic cable is made from surprisingly skinny strand of glass or plastic called optical fiber; one cable may additionally have as few as strands

or as numerous as many masses. Every strand is plenty tons less than a 10th as thick as a human hair and might includes some problem like 25,000 cellphone calls, consequently an entire fiber-optic cable will honestly incorporates such a whole lot of million calls. Optical fibers are used maximum frequently as way that to transmit light among the two ends of the fiber and apprehend large utilization in fiber optic communications, anywhere they enable transmission over longer distances and at better facts measure (records fees) than twine cables. Fibers are used rather than steel wires due to the fact signs and symptoms tour alongside them with lesses quantities of loss; additionally, fibers are evidence towards electromagnetic interference, a trouble from that metallic wires undergo overly. Fibers are used for illumination, and are wrapped in bundles so they may be used to carry snap shots, so allows to viewing in limited areas, as within the case of a fiberscope. especially designed fibers are used for a variety of numerous applications, a number of them being fiber optic sensors and fiber lasers.

Optical fibers usually include a transparent center surrounded with the beneficial useful resource of a obvious cladding cloth with a lower index of refraction. slight is saved inside the center through the phenomenon of common inner pondered image which motives the fiber to behave as a waveguide. Fibers that help many propagation paths or transverse modes are called multi-mode fiber (MMF) at the equal time as folks who aid a single mode are called unmarried-mode fiber (SMF). unmarried mode cable is a unmarried stand of glass fiber with a diameter of eight.three to ten microns, that has one mode of transmission. unmarried Mode Fiber with fantastically narrow diameter, via which most effective one mode will propagate normally 1310 or 1550 nm. consists of higher bandwidth that multimode fiber however calls for a mild deliver with a slender spectral width. Synonyms are mono-mode optical fiber offers you a higher transmission charge and as an awful lot as 50 instances more distance that multimode, however it additionally prices more.unmarried mode fiber has a miles smaller middle than multimode. The small core and unmarried moderate-wave in reality do away with any distortion that could end result from overlapping moderate pulses, providing