



**Faculty of Electrical and Electronic Engineering Technology**



**DEVELOPMENT OF WIRELESS MEASUREMENT DIAL GAUGE**

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**Bachelor of Electronics Engineering Technology (Industrial Electronic) with  
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# **DEVELOPMENT OF WIRELESS MEASUREMENT DIAL GAUGE**

**THINESH KUMAR A/L GANESAN**

**A project report submitted  
in partial fulfillment of the requirements for the degree of  
Bachelor of Electronic Engineering Technology (Industrial Electronic) with Honours**



**Faculty of Electrical and Electronic Engineering Technology**

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I declare that this project report entitled “Development Of Wireless Measurement Dial Gauge“ is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Industrial Electronic) with Honours.

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## DEDICATION

*I like to dedicate this thesis to my beloved parents because they have supported me fully since I started to do this thesis. Their love and support have made me more confident to do this thesis.*



## ABSTRACT

In this technology era, most companies are implementing digital technology to enhance their production rate and quality. Implementation of this technology will ease the company in many perspectives and also will bring many profits. In current days, most companies are improving their company with the latest technology as it will reduce human error mainly in process of data logging. Most of the latest developed systems are using the wireless protocol. The wireless system is used to control a system from far with no cable connection. The purpose of the system is to enhance the digital dial gauge to perform the task of wireless data logging, eliminate inaccuracies in data logging with automated data transfer, and avoid loss of data measured by saving it straight away into notepad and will be imported to Microsoft Excel by using Visual Basic Application. ESP32 has been used to control the input and output. The digital dial gauge has been utilized for the purpose of measurement, the measured data will be transferred to laptop or personal computer via Bluetooth function of ESP32. The project is simple to handle and it is a good enhancement for the process of measuring and recording data.

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## ***ABSTRAK***

Pada era perindustrian 4.0 ini, kebanyakan syarikat menggunakan teknologi digital untuk meningkatkan kadar pengeluaran dan kualiti pengeluaran mereka. Pelaksanaan teknologi ini akan memudahkan syarikat dalam banyak perspektif dan juga akan membawa banyak keuntungan. Pada masa kini, kebanyakan syarikat memperbaiki syarikat mereka dengan teknologi terkini kerana ini akan mengurangkan kesalahan manusia terutama dalam proses memasukkan data. Sebilangan besar sistem yang dibangunkan pada masa kini menggunakan protokol tanpa wayar. Sistem tanpa wayar digunakan untuk mengawal sistem dari jarak jauh tanpa menggunakan kabel. Objektif sistem ini meningkatkan pengukur dail digital untuk melakukan tugas pencatatan data tanpa wayar, menghentikan masalah ketidaktepatan dalam log data dengan pemindahan data automatik, dan mengelakkan kehilangan data yang diukur dengan menyimpannya di notepad dan akan di import ke Microsoft Excel. ESP32 telah digunakan untuk mengawal proses sistem ini dan pemindahan data ke Microsoft Excel dengan menggunakan fungsi Bluetooth. Tolok dail digital adalah digunakan dalam proses pengukuran, data yang diukur akan dipindahkan ke kemudian akan dipindahkan ke komputer riba melalui ESP32 yang mempunyai fungsi Bluetooth. Projek ini senang untuk dikendalikan dan merupakan penambahbaikan yang bagus bagi sistem pengukuran dan log data.



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## TABLE OF CONTENTS

	<b>PAGE</b>
<b>DECLARATION</b>	
<b>APPROVAL</b>	
<b>DEDICATIONS</b>	
<b>ABSTRACT</b>	<b>i</b>
<b>ABSTRAK</b>	<b>ii</b>
<b>ACKNOWLEDGEMENTS</b>	<b>iii</b>
<b>TABLE OF CONTENTS</b>	<b>i</b>
<b>LIST OF TABLES</b>	<b>iii</b>
<b>LIST OF FIGURES</b>	<b>iv</b>
<b>LIST OF SYMBOLS</b>	<b>vi</b>
<b>LIST OF ABBREVIATIONS</b>	<b>vii</b>
<b>LIST OF APPENDICES</b>	<b>viii</b>
<b>CHAPTER 1 INTRODUCTION</b>	<b>1</b>
1.1 Project Background	1
1.2 Problem Statement	1
1.3 Objective	2
1.4 Scope of Research	2
1.5 Conclusion	2
<b>CHAPTER 2 LITERATURE REVIEW</b>	<b>4</b>
2.1 Introduction	4
2.2 Dial Gauge	4
2.2.1 Machine vision based automatic detection method of Indicating values of a pointer Gauge	5
2.2.2 Calibration of dial indicator using machine version	6
2.2.3 Digital dial gauge using potentiometer	7
2.3 Wireless Technology in industrila network	8
2.3.1 Bluetooth low energy: wireless connectivity for medical monitoring	9
2.3.2 Wireless arduino based weather station	10
2.3.3 Smart home for elderly care, based on wireless sensor network application of wireless technology	11
2.4 Application of wireless technology	13
2.4.1 Real time energy measurement using smart meter	14

2.4.2	Internet of things based smart home system using ESP32 Microcontroller	15
2.4.3	Low cost wireless ECG patch using ESP32	16
2.5	Wirless data logging system	17
2.5.1	A low cost versatile data logging system for ecological application	18
2.5.2	Using chemduino, Excel and powerpoint as a tool for real time measurement representation in class	19
2.5.3	PLX-DAQ based wireless batery monitoring system for abstacle avoidance robot	20
2.6	Comparison of past related research	22
2.7	Difference between ESP32 and ESP8266	27
2.8	Conclusion	28
<b>CHAPTER 3 METHODOLOGY</b>		<b>29</b>
3.1	Introduction	29
3.2	Process flow	29
3.2.1	Identification of problem statement	31
3.2.2	Analysis of lierature review	31
3.2.3	System flow	31
3.3	project component	33
3.4	Designing hardware circuit	33
3.4.1	ESP32 Microcontroller	34
3.4.2	Digital dial gauge	35
3.5	Utilization of software	36
3.5.1	ESP32 System	36
3.5.2	CoolTerm Software	36
3.6	Conclusion	37
<b>CHAPTER 4 RESULT AND DISCUSSION</b>		<b>38</b>
4.1	Introduction	38
4.2	The data collection process	38
4.3	Hardware Utilized	40
4.3.1	Digital Dial Gauge	40
4.3.2	NodeMCU ESP32	42
4.4	Software Utilization	42
4.4.1	Development of the circuit	43
4.4.2	NodeMCU ESP32 coding	43
4.5	Result Analysis	44
4.5.1	Result of the project	46
4.5.2	Digital dial gauge	46
<b>CHAPTER 5 CONCLUSION AND RECOMMENDATIONS</b>		<b>54</b>
5.1	Conclusion	54
5.2	Recommendation	55
<b>REFERENCES</b>		<b>56</b>

## LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	Comparison between ESP8266 and ESP32	27



## LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1	Image analysis methods to read the pointer gauge value automatically	6
Figure 2.2	Progress of Automatic Reading of The Pointer Gauge	6
Figure 2.3	Working principle of the device	7
Figure 2.4	The design of the device	8
Figure 2.5	Work flow of Bluetooth Module	10
Figure 2.6	Data view in ThingSpeak	11
Figure 2.7	Flow of data processing in LabVIEW	12
Figure 2.8	Work flow of Arduino ATmega2560	13
Figure 2.9	Connection diagram of the Smart Meter	14
Figure 2.10	Process flow of the system	17
Figure 2.11	Components of ECG patch	17
Figure 2.12	Nanologger attached to Sensor	19
Figure 2.13	PLX-DAQ system	20
Figure 2.14	Process flow of the system	21
Figure 3.1	Flow Chart of Project development	30
Figure 3.2	Flow Chart of System works	32
Figure 3.3	Connection of Arduino ESP32	34
Figure 3.4	ESP32 Microcontroller	35
Figure 3.5	Dial gauge	35
Figure 3.6	Installation of ESP32 library in Arduino IDE	36
Figure 3.7	CoolTerm data retrieving system	37

Figure 4.1	Respondents percentage	39
Figure 4.2	Respondents answers in term of percentage for first question	39
Figure 4.3	Respondents answers in term of percentage for second question	40
Figure 4.4	Data port of the dial gauge	41
Figure 4.5	ESP 32 code to enable Bluetooth	44
Figure 4.6	ESP 32 connected to laptop via Bluetooth	44
Figure 4.7	Data collected in 1minute using two different method	45
Figure 4.8	Project prototype	46
Figure 4.9	Measured thickness value of RFID card	47
Figure 4.10	Gage R&R result for RFID card	48
Figure 4.11	Result of the components variance method	48
Figure 4.12	Graph of average measured thickness value of RFID card	49
Figure 4.13	Measured thickness value of sim memory card	49
Figure 4.14	Gage R&R result for memory card	50
Figure 4.15	Result of the components variance method	50
Figure 4.16	Graph of average measured thickness value of memory card	51
Figure 4.17	Measured thickness value of PCB	51
Figure 4.18	Gage R&R result for PCB	52
Figure 4.19	Result of the components variance method	52
Figure 4.20	Graph of average measured thickness value of PCB	53

## LIST OF SYMBOLS

$\Omega$	-	Ohm
%	-	Percent



## LIST OF ABBREVIATIONS

IoT	-	Internet of Thing
ESP	-	Espressif
GR&R	-	Gage Repeatability and Reproducibility





## LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	NodeMCU ESP32 code	57
Appendix B	Visual Basic Application code	59
Appendix C	Designed circuit	60
Appendix D	Gannt Chart	61



# CHAPTER 1

## INTRODUCTION

### 1.1 Background

This project is developed to enhance the method that is being utilized by CTRM company in which manpower is employed to measure and record the data manually. The major objective of the project is to enhance a cost-effective and time-effective method as well as to reduce the supply of manpower for the processes of measuring and recording using a dial gauge. Hence, all these effective workers used for this work can be utilized in different departments which can raise the company's productions, sales, and profits.

Human error can be deducted when the automated method is used for data logging. Besides, a study can be done using the previous reading and used as a backup record for research and development purposes. Hence for this project, a digital dial gauge is preferred than an analog dial gauge because it will produce digital data and it would be quickly transferred to a microcontroller and it is way more accurate and precise.

### 1.2 Problem Statement

In this era of technology, still many industries are using manual methods to perform a measurement and to record the data. This problem is faced by CTRM company and it gives a big impact on the production rate of the company. Next, when the data is recorded manually, there are high chances of inaccuracies in data logging due to human error. Moreover, the data that has been taken and recorded manually has many possibilities to miss or get deleted

### 1.3 Objective

Objectives of the project:

- a) To enhance the existing dial gauge to perform automated wireless data logging and recording data.
- b) To eliminate inaccuracies data logging with automated data transfer.
- c) To store data in Microsoft excel which decrease the probability of data lost.

### 1.4 Scope of Research

This are the scopes of research for this project:

- a) The scope of the project is using ESP32 microcontroller to control the data transmission process
- b) This ESP32 is integrated with Bluetooth connectivity that used for accurate data transmission between the microcontroller and the computer.
- c) The data logged into excel is saved in xlsx file format.

### 1.5 Conclusion

This project focuses on the wireless dial gauge. The report of this project is separated into five chapters. The first chapter entitles 'Introduction' will explain the overview of the project, objective, scope of research, and problem statement. The second chapter entitled 'Literature review' will describe the previous research which is related to this project. This will describe the technology and method that has been used to complete the project. Next, the advantage and disadvantages of the previous research also is described in this chapter. Chapter three entitled 'Methodology' will describe the electronic components,

circuits, and wireless technology that are planned to be used for this project. Chapter four entitled 'result and discussion' which will describe about the result that has been obtained. Finally, chapter five is conclusion, this part will explain on the overview of the project and also the enhancement that can be done to the project in future.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter will explain the summary of the recently invented project. The researches and studies have been performed on the project, where the data is collected so that it is possible to refer to the idea of the new technologies. This also gives an idea regarding a project and also what are components and software need to be used in developing a project. The research for literature review is done with the help of certain applications such as Google Scholar, Mendeley Scopus, and others. This application has helped us to find journals related to the projects. The literature review of this project was divided into few parts such as measurement, wireless data transfer, and automated data logging system.

#### 2.2 Dial Gauge

The Dial gauge is one of the most common and prominent measuring tools used in most of the industry in our country. The dial gauge function is to check the flatness of the surface and detect any minor difference in the linear measurement of the same objects. Approaches use by human gives alteration of measurement taken, the types of condition measurement need to be recorded gives the purpose of dial gauge. The aspect of measurement the condition such as the surface thickness gives the difficulty for human analysis this where the equipment like as Dial Gauge comes in, interpreting the measurement of the width, length and thickness of a sophisticated element. The precision and accuracy of

recorded measurement is important and avoid any misinterpretation to certain factor of recording. (Schlesinger, 2009).

### **2.2.1 Machine Vision Based Automatic Detection Method of Indicating Values of a Pointer Gauge.**

In this technology era, digital technology is the most applied technology in most of the industries. As technology is getting advanced, the nation was introduced with digital meter technology. Although digital technology is more advance but still pointer gauge was famous among many fields because of its simple structure, high reliability, low cost, and simple to operate but one of the major disadvantages of this pointer gauge system is it not able to communicate with a computer to perform remote data transmission. The latest digital features have to be implemented on pointer gauge so that perform automated reading and convert the gathered data into the digital signal and kept in a computer. The manual method to measure and collect data requires a lot of manpower and it increases the companies expenditures. The implementation of this system will help to reduce the number of workers on the data collection side and the problem of inaccuracies of data logging due to human error also can be solved. First of all, in this process, the region growing method has been used to identify the location of the dial region and the center point of the gauge. Next, the adaptive threshold method under the polar coordinate system has been used to identify the circular scale region. Thirdly, the scale mark distribution diagram in the circular region is produced by using improved central projection. Hough transformation is utilized to distinguish the pointer at the dial region and get its direction. Lastly, the indicating value of the gauge is get by comparing the direction of pointer with the scale's position and this step known as the distance method.(Chi et al., 2015)

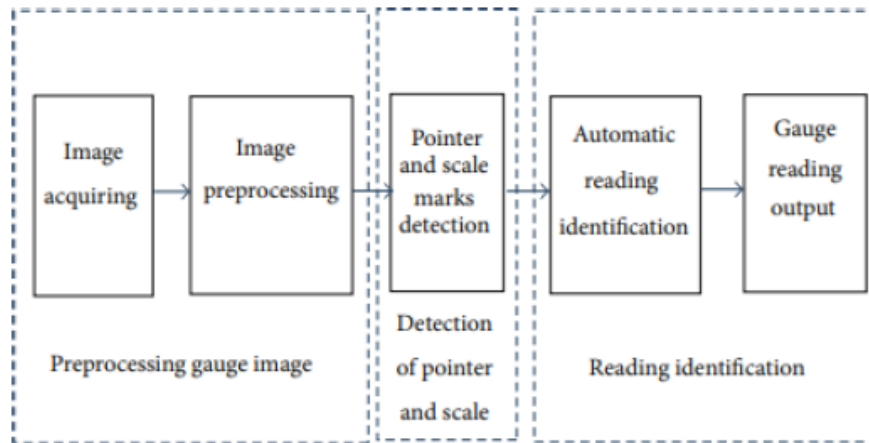


Figure 2. 1: Image analysis methods to read the pointer gauge value automatically (Chi et al., 2015)

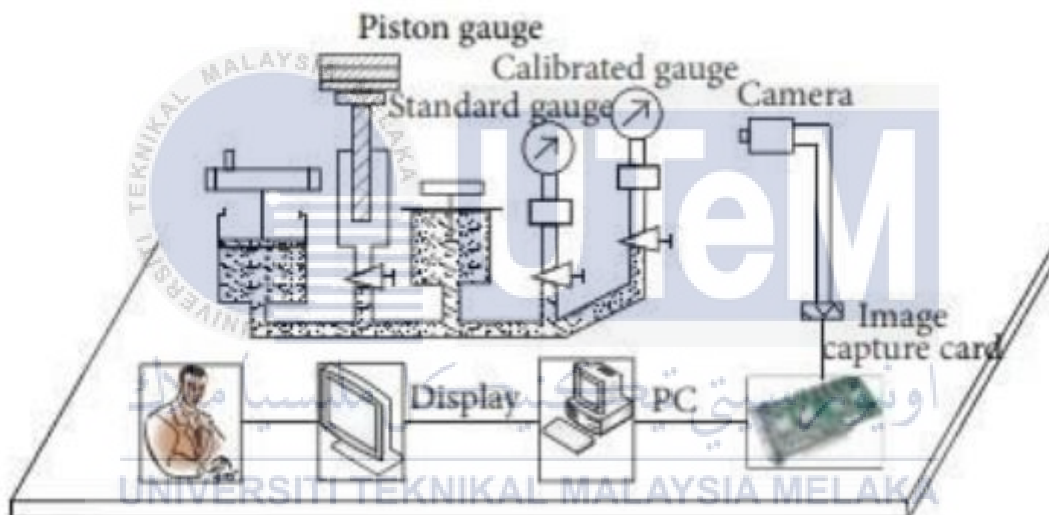


Figure 2. 2: Progress of Automatic Reading of The Pointer Gauge (Chi et al., 2015)

### 2.2.2 Calibration of dial indicators using machine vision

Dial indicator is one of the most prominent measuring tools in the industry. The rate of usage of this tool is frequent until it can cause damage to the device each year. The damage of the dial indicator maybe cannot be seen through our eyes but it affects the measurement value of the dial indicator. The manual calibration can be done but this problem most cannot be identified with the method. When measured data have error it will affect the next process and finally will cause loss for the company. The calibration of the dial indicator

using machine vision will provide a detailed picture of the problem. Apart from that, this project is it is cheap in terms of costing and easy to install. This method utilized the function of a video camera and a motor-driven length transducer. Michelson interferometer is used to measure the displacement of a dial indicator rod. An angular transistor which was equipped with a phototransistor is put on the dial indicator. This system consists of two length transducer and a red led ring light together with a camera. A ring light was set in a higher position so that no light so the shadow will fall on the glass of the dial indicator. The transducer were utilized to measure the point of the stage and that data has been used as a source to remove the error. The implementation of this system, it makes possible to check many points on the dial indicator scale.(Hemming & Lehto, 2002)

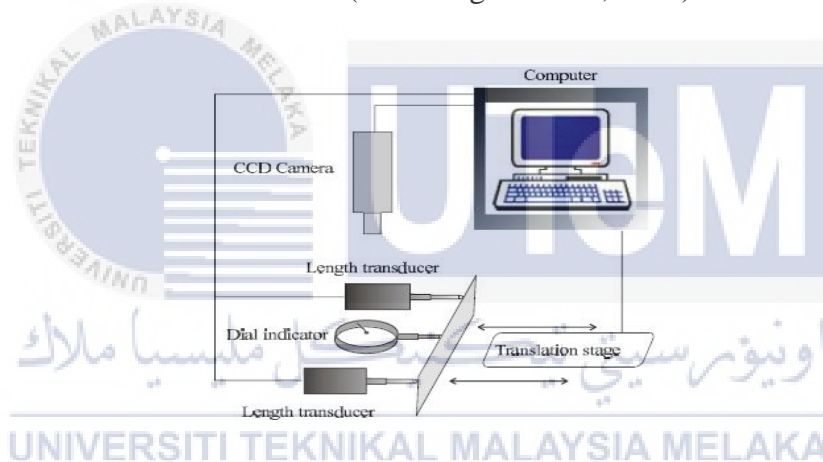


Figure 2.3 Working principle of the device(Hemming & Lehto, 2002)

### 2.2.3 Digital dial gauge using potentiometer

Digital dial indicator is developed to measure the flatness of a surface. The length travelled by the knob is calibrated by utilizing. A potentiometer was adjusted to get the distance travelled by the knob in the linear range. GUI software has been utilized to present the digital output. Several components have been used in this project, those components are Door latch to implement the vertical movement mechanism. Next, a Forex board was used to create the casing of the device. A slider model potentiometer is applied to detect the displacement and provides output voltage in form of analogue. Arduino Uno is used to