

BONA FIDE CERTIFICATE

Certified that this project report “**DESIGN AND DEVELOPMENT OF BRAKE PAD WEAR INDICATOR FOR FOUR WHEELERS**” is a bona fide work of

M. SIVASURYAN (2014111053)

R. AJITKUMAR (2014111067)

M. SABARISAN (2014111112)

M. SANTHOSH KUMAR (2014111113)

who carried out the project work under my supervision, for the partial fulfilment of the requirements for the award of the degree of Bachelor of Engineering in Mechanical Engineering. Certified further that to the best of my knowledge and belief, the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or an award was conferred on an earlier occasion on these or any other candidate(s).

Dr . B. MOHAN

Professor & Head

Department of Mechanical

Engineering ,

College of Engineering Guindy,

Anna University, Chennai- 600 025.

Mr. S. RAGAVANANTHAM

Assistant Professor & Guide ,

Internal Combustion Engineering

Division ,

Department of Mechanical

Engineering ,

College of Engineering Guindy,

Anna University, Chennai- 600 025.

ABSTRACT

The aim of this project is to develop a brake pad wear indicator for the four wheelers. Brake is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle by means of friction. The friction is achieved by means of drum brakes and brake pads in four wheelers. The brake pad wears out after a certain period of use. If the brake pads are left unchanged, the worn out brake pad may cause metal to metal contact between rotor and master cylinder. This may cause difficulty in slowing down the four wheeler and they may ultimately lead to accidents. In order to reduce such accidents, which happen mainly due to the negligence of the driver, a brake pad wear indicator is developed which indicates the driver about the thickness of the brake pad and to replace it when it reaches the minimum thickness.

ACKNOWLEDGEMENT

We are highly indebted to our guide **Mr. S. RAGAVANANTHAM**, Assistant Professor, Engineering Design Division, Department of Mechanical Engineering, College of Engineering Guindy, Anna University, for his useful suggestion, moral support, sustained interests and encouragement throughout the project.

We consider it a privilege to thank **Dr. B. MOHAN**, Professor and Head, Department of Mechanical Engineering, College of Engineering Guindy, Anna University, for providing facilities for the successful completion of the Project.

We owe our sincere thanks to our Project coordinator **Dr. G. SHIBU**, Assistant Professor (Sr.Gr), Engineering Design Division, Department of Mechanical Engineering, College of Engineering Guindy , Anna University, for providing us with all facilities for the project.

We are extremely grateful to our review committee members **Dr. M. VENKATA RAMANAN**, Assistant Professor (Sr.Gr), Institute for Energy Studies, **Dr. K. THIRUMAVALAVAN**, Assistant Professor (Sr.Gr), Central Workshop Division, Department of Mechanical Engineering, College of Engineering Guindy, Anna University, for their valuable suggestions for this Project.

SIVA SURYAN M (2014111053)

SABARISAN M (2014111112)

AJITKUMAR R (2014111067)

SANTHOSH KUMAR M (2014111113)

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
	ABSTRACT	ii
	ACKNOWLEDGEMENT	iii
	LIST OF FIGURES	vii
	LIST OF SYMBOLS	ix
1	INTRODUCTION	1
	1.1. BRAKE TYPES BASED ON ACTUATION	1
	1.2. BRAKE TYPES BASED ON APPLICATION	1
	1.3. PRINCIPLE OF BRAKING SYSTEM	2
2	LITERATURE REVIEW	4
3	DEVELOPMENT OF BRAKING SYSTEM	5
4	CLASSIFICATION OF BRAKES BASED ON APPLICATION	7
	4.1. DRUM BRAKES	
	4.2. PARKING BRAKES	8
	4.3. DISC BRAKES	9
5	THEORY OF CONVENTIONAL HYDRAULIC DISC BRAKE	10

	5.1. ADVANTAGES OF DISC BRAKES	11
	5.2. DISADVANTAGES	12
6	BRAKE PADS	13
	6.1. OPERATIONAL REQUIREMENTS	13
	6.2. MATERIAL CHARACTERISTICS	14
	6.3 WEAR AND DAMAGE CHARACTERISTICS	15
	6.3.1. Thermal destruction of the brake pad	15
	6.3.2. Edge contact between plate and disc	17
	6.3.3. Slanting wear	18
	6.3.4. Uneven wear	18
	6.3.5. Edge pitting	19
	6.3.6. Crack formation by thermal load	20
	6.3.7. Brake pad at wear limit	21
	6.4. WEAR ANALYSIS	22
7	SENSOR	25
	7.1. INFRA RED SENSOR	25
	7.1.1. IR transmitter	26
	7.1.2. IR receiver	26
	7.1.3. Principle of Working	27

8	COMPONENTS AND WORKING OF BRAKE PAD WEAR INDICATOR	29
	8.1. POSITION OF SENSOR IN BRAKE PADS	29
	8.2. SENSOR MODULE	30
	8.3. CIRCUIT DIAGRAM FOR SENSOR	30
	8.4. COMPONENTS USED	32
	8.4.1. 10 segment display bar	32
	8.4.2. 9 volt battery	33
	8.4.3. Resistance wire	34
	8.5. ADVANTAGES	34
9	COST ESTIMATION	35
10	CONCLUSION	36
	REFERENCES	37

LIST OF FIGURES

FIG.NO.	DESCRIPTION	PAGE NO.
1.1	TYPICAL AUTOMOTIVE BRAKING SYSTEM	2
5.1	HYDRAULIC DISC BRAKE	10
6.1	THERMAL DESTRUCTION OF BRAKE ROTOR	16
6.2	RING SHAPED FRICTION CONTACT	17
6.3	SLANTING WEAR	18
6.4	EDGE PITTING	19
6.5	CRACK FORMATION	20
6.6	WEAR AT LIMIT	21
6.7	GRAPH BETWEEN PAD WEAR AND BRAKE TEMPERATURE	24
7.1	IR TRANSMITTER	26
7.2	IR RECEIVER	26
7.3	WORKING OF IR SENSOR	27
7.4	IR SENSING CIRCUIT	28
8.1	CATIA DIAGRAM FOR SENSOR POSITIONING	29
8.2	SENSOR MODULE	30
8.3.1	CIRCUIT DIAGRAM FOR SENSOR CONNECTION	31
8.3.2	BEFORE THE WEAR LIMIT HAS REACHED	31

8.3.3	AFTER REACHING THE WEAR LIMIT	32
8.4.1	10 SEGMENT DISPLAY BAR	33
8.4.2	9-VOLT BATTERY	33
8.4.2	RESISTANCE WIRE	34

LIST OF TABLES

TABLE NO.	NAME	PAGE NO.
6.1.	EFFECT OF SPEED ON BRAKE PAD WEAR AT CONSTANT CONTACT PRESSUE OF 10 BAR	24

LIST OF SYMBOLS

P	-	PRESSURE
F	-	FORCE
A	-	AREA
T	-	TORQUE
μ	-	COEFFICIENT OF FRICTION
Θ	-	ANGULAR DIMENSION
Pa	-	PASCAL
K	-	KELVIN
Ω	-	OHM
V	-	VOLT

LIST OF ABBREVIATIONS

ABS	-	ANTI LOCK BRAKING SYSTEM
DPN	-	DIAMOND PYRAMID HARDNESS
IR	-	INFRA RED
LED	-	LIGHT EMITTING DIODE
IC	-	INTEGRATED CIRCUIT