UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE DEVELOPMENT OF PROTOTYPE OF
AUTOMATIC WINDSHIELD WIPER

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

by

MUHAMMAD SHAZNI BIN JAMEL
B071410807
930425-13-5033

FACULTY OF ENGINEERING TECHNOLOGY
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DECLARATION

I hereby, declared this report entitled "The Development Of Prototype Of Automatic Windshield Wiper" is the results of my own research except as cited in the references.

Signature   :   …………………..

Author's Name   :   …………………………………………………

Date   :   …………………..

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

……………………………….
(Mr. Azwan Bin Aziz)

ABSTRAK

Dalam industry automotif, terdapat banyak jenis automasi yang telah diperkenalkan dan salah satu daripadanya adalah pengelap cermin automatik. Peranti ini digunakan untuk mengelap cermin secara pintar berdasarkan kadar hujan samada hujan lebat, hujan sederhana atau hujan renyai-renyai. Sensor hujan digunakan untuk mengesan kadar hujan dan kemudian memberikan semula isyarat kepada Atmega328P yang bertindak sebagai pengawal mikro dalam sistem ini. Isyarat yang dihasilkan daripada pengesan akan melalui litar penyesuai isyarat supaya isyarat keluarannya bersesuaian dengan julat pada Penukar Analog ke Digital. Isyarat tadi akan ditukarkan kepada bentuk digital dan kemudiannya Atmega328P akan membuat keputusan untuk memberikan keluaran kepada motor samada untuk bergerak pada kelajuan rendah berterusan, kelajuan sederhana atau kelajuan tinggi. Pemacu motor digunakan untuk memacu kelajuan motor dan juga untuk melindungi pengawal mikro daripada voltan aruhan balikkan (emf) yang dihasilkan oleh motor.

ABSTRACT

In automotive industry, there are many types of automation has been introduced and one of it is automatic windshield wiper. This device is used to wipe the windshield intelligently based on the rain precipitation either heavy, medium or drizzle rain. Rain sensor is used to sense the rain precipitation and then give back the sense signal to the Atmega328P as a microcontroller of this system. From the sensor, the signal will pass through the signal conditioning in order the output range from the sensor with the Analog-to-Digital Converter (ADC) range. The signal will be converted and the Atmega328P will decide to give the output to the motor either to low speed, medium speed or high speed. The motor driver is used to protect the microcontroller from the back emf generate by the motor and also used to drive the motor.

DEDICATIONS

This project and research work is dedicated to my beloved parents, for their devoted caring throughout my life, my beloved brothers and sisters, who give the inspiration to me and also my friends for their encouragement. Without their support this report may not have been done.

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INTRODUCTION

1.0   Introduction

This chapter discuss the background, problem statement, objectives and scope of the study. It is including the statistics about the rapidity of vehicles and history of a wiper as a device system to remove rain from a windscreen. This chapter will state about the objective and the work scope of this study and also shows the view of the research work.

1.1   Background of study

Nowadays, the development of modern electronic equipment in the automotive industry has been developong rapidly and has been received in many countries and even our country, Malaysia is no exception in exploiting these development. This is because it is the development of reliability, entertainment and security for vehicles. In helping in reduced the potential of accidents and improved road safety, the research and development department (R&D) for the automotive has made many research so as to created a lot of intelligent transport system (ITS) to overcome the problems faced. In evaluating the vehicle environment and helping drivers with safer driving, there are many of intelligent sensing and control algorithm that have been used in smart vehicles (N. ANJU LATHA & B. RAMA MURTHY, 2016).

According to (Jawi et al., 2009) state that the weather is one of the environmental risk factors that affect the performance of all main components in a "moving vehicle" which include the driver and prevailing road condition. Besides that, weather-road safety is a issues that the effects of weather variables contributing to road accidents not only in our ountry but also in another country . Many studies in relation to precipitation had proven thats its effects to the road transportation are significant towards accident rate and risk (Bijleveld & Churchill, 2009).

Table 1. 1 : New registered vehicles by state and type, Malaysia, 2014

NEGERI State	MOTOSIKAL Motorcycle	MOTOKAR Motorcar	BAS Bus	TEKSI Taxi	KERETA SEWA PANDU SENDIRI Hire & Drive Car	KENDERAAN BARANG-BARANG Goods Vehicle	LAIN-LAIN Others	JUMLAH Total
PERLIS	4,603	1,604	2	0	0	33	24	6,266
KEDAH	40,987	13,456	36	21	25	955	489	55,969
PULAU PINANG	47,203	40,053	267	201	65	2,973	743	91,505
PERAK	41,577	26,699	174	11	25	2,273	1,053	71,812
SELANGOR	70,813	31,177	225	2,411	314	8,294	5,464	118,698
W.P. KUALA LUMPUR	80,606	191,012	756	2,363	4,214	11,419	3,252	293,622
NEGERI SEMBILAN	18,869	10,127	51	11	3	1,988	211	31,260
MELAKA	16,791	12,169	28	6	3	760	510	30,267
JOHOR	76,003	58,136	286	562	14	5,723	2,305	143,029
PAHANG	23,344	12,309	23	6	1	1,215	513	37,411
TERENGGANU	16,833	7,951	15	5	1	417	50	25,272
KELANTAN	27,311	12,402	39	5	1	583	95	40,436
SABAH	32,718	35,169	277	118	177	3,021	1,875	73,355
SARAWAK	43,727	40,457	81	47	140	3,696	2,880	91,028
PORTAL RAKAN NIAGA	2	171,614	0	1	8	355	26	172,006
MALAYSIA	**541,387**	**664,335**	**2,260**	**5,768**	**4,991**	**43,705**	**19,490**	**1,281,936**

SUMBER : JABATAN PENGANGKUTAN JALAN
Source : Road Transport Department

Table 1. 2: Total vehicles by state and type, Malaysia, 2014

NEGERI *State*	MOTOSIKAL *Motorcycle*	MOTOKAR *Motorcar*	BAS *Bus*	TEKSI *Taxi*	KERETA SEWA PANDU SENDIRI *Hire & Drive Car*	KENDERAAN BARANG-BARANG *Goods Vehicle*	LAIN-LAIN *Others*	JUMLAH *Total*
PERLIS	73,621	22,833	175	126	79	1,982	2,266	101,082
KEDAH	853,278	314,324	2,940	2,319	1,370	38,957	30,499	1,243,687
PULAU PINANG	1,311,249	1,064,250	5,006	3,713	1,685	75,364	38,953	2,500,220
PERAK	1,274,019	726,350	4,601	3,664	878	73,723	59,404	2,142,639
SELANGOR	1,273,286	1,068,420	6,460	14,647	1,990	181,434	133,718	2,679,955
W.P. KUALA LUMPUR	1,707,324	3,633,331	18,144	54,057	41,905	258,614	236,110	5,949,485
NEGERI SEMBILAN	514,775	322,283	2,460	1,933	564	46,899	16,310	905,224
MELAKA	433,604	322,338	1,673	1,554	431	27,443	13,709	800,752
JOHOR	1,722,944	1,397,582	8,482	12,370	2,754	145,404	96,188	3,385,724
PAHANG	548,213	359,248	1,953	1,888	982	45,220	28,536	986,040
TERENGGANU	354,736	196,226	1,042	925	327	21,994	13,414	588,664
KELANTAN	502,917	285,542	1,980	1,521	587	29,343	16,572	838,462
SABAH	338,902	591,868	7,042	4,566	3,779	121,021	98,123	1,165,301
SARAWAK	720,395	723,701	3,086	2,405	1,606	92,119	98,639	1,641,951
PORTAL RAKAN NIAGA	2	171,614	0	1	8	355	26	172,006
MALAYSIA	**11,629,263**	**11,028,296**	**65,044**	**105,688**	**58,937**	**1,159,517**	**882,441**	**25,101,192**

SUMBER : JABATAN PENGANGKUTAN JALAN
Source : Road Transport Department

Table 1.1 shows the current registered vehicles according their types and state in Malaysia for the year 2014 respectively. From the table, it can be observed that a huge number of vehicles have been registered which lead to an increasing nunmber of vehicles and road user. The total vehicles by state and type in Malaysia for year 2014 can be referred to Table 1.2. Based on the statistic, it can be concluded that the rapid increase of vehicles can be seen even within the same year. The addition of these vehicles can also contribute to the accident of vehicles.

Table 1. 3: Number of road accidents according to weather condition

in year 2014

Weather	Total	Percentage
Fine	88 875	90.82
Windy	306	0.31
Foggy	1 705	1.74
Rain	6 970	7.12
TOTAL	97 856	100.00

Table 1.3 shows the biggest number of the road accidents happens in five weather and followed by rain, foggy and windy condition. From the table, it can observed that weather condition with precipitation related accident being the most prominent factor.

1.1.1 History of Windshield Wiper

In 1903, it was the first history of windshield wiper was introduced dan patented for a window as the cleaning device. The first mechanical windshield wipers had to be operated by using a hand. The driver or passenger need to work a hand to make the wipers go backward and forward. In 1916, squeegees was take place to replacing the manual windshield.

In 1921, the automatic windshield wipers was invented and it was called "Folberths" because Fred and Willaim Folberth is the inventors of a machine

known as an "air engine", a device connected by a tube to the inlet pipe of the car's motor.

In 1926, a company called "Bosch" was created a electric version for windshield wipers and it was attached to the top of the windshield but was commonly used only for luxury models.

Next, Intermittent powered wipers were introduced and patented by Robert Kearns in 1967. Robert Kearns introduce the system to Ford Motor and demonstrated the system to them. After that, other automaker soon followed.

1.1.2   Project Overview

A common feature throughout the world, the automatic windshields wipers that detect the rain precipitation using a rain sensor. The sensor automatically adjusts the speed of the blades according to the amount of rain precipitations being detected.

The core objectives are minimizing the effort put by driver in controlling the speed of the wiper and put more concentration on his driving.besides that, the automated systems have flexibility, reliability, less manual operations and accuracy in the present days. Every field favours such control systems due to this demand.

In early 2006, rain-sensing wipers are optional or standard on all Volkswagen and Nissan's 2000SX/Silvies was the first model using rain-sensing windscreen wipers. Since this system has many luxury cars has been successfully

working, an effort was made to reduce the cost of the system so that this system can be implemented in common economic cars where a common man can also enjoy the benefits.

1.2   Problem Statement

Wiper is an essential component that used to wiper raindrops or any water from vehicle's windscreen (Hashim et al., 2013). The previous system used manually and semi-auto to active the wiper. In manual process, the driver need to switch on and off the control stalk and it wil reduce the driver concentration towards driving. In semi-auto process, the driver need to switch in auto mode when want to use and turn off this system when not in use. This semi-auto process still using the control stalk to control the speed of the wiper. Thus, this system is proposed to solve these problem.

The concept of this proposed wiper system is just the same with other conventional wiper that is for removing water from windscreen. This system will upgraded to an automatic control system by using the effect of piezoelectric sensor. When the water hit sensor, the pressure (stress) is applied to a material and it will creates a strain in the material. This strain creates an electrical potential difference (voltage) and this voltage will send signal to the system for moving the wiper motor. Once sensor did not detect any water, the wiper will stop. This will rrduce thr weakness which have been stated at beginning. Additional plan to this invention is to make the wiper automatically push up from the windscreen when the engine shut off.

1.3   Objectives

1.3.1   General Objective

The general objective in this project is to develop a prototype of antomatic windshield system by using an Arduino Uno Controller

1.3.2   Specific Objective

The specific objectives of this project are ;

   i.   To develops the prototype of automatic wiper by using a
         microcontroller (Arduino Uno)
   ii.   To apply the Rain Sensor effect to detect the raindrop on the
         windshield.

1.4   Scope of Work

The system shows the two way communication between this modules. Arduino Uno as a controller element to control transmitting data. The system is expected to be operated in single modes which is automatic mode. A switch will provide to stop the wiper when there is dirt at the windshield screen.

There are three different speeds are expected to be provided for this system. The speed will automatically change depend on the rain precipitation. The three different speed are intermittent delay speed, low speed and high speed

The system is to be developed using Arduino Uno controller. This is due to the fact that Arduino is a easy system to program and cheap.

1.5   Conclusion

In order to afford cost effective solution, Arduino and Rain sensor can be used in automatic windshield wiper. In this wiper system, the involvement of manpower could be reduced and the system will give better benefit to users. This system is very flexibility and more efficient. Besides that, this system can used for all types of vehicles. Therefore, everyone can enjoy the benefits of this system.

By this chapter, the clear views of introduction and background for this project is stated in order to show the initial ideas and the motives of this project for being conducted. The literature of the previous and related study will be explained in the Chapter 2.

CHAPTER 2

LITERATURE REVIEW

2.0   Introduction

In this chapter, the literature has been studied to gain the knowledge and material that linked to the project. This link of information is obtained from journals, books, thesis and others from former studied. The working and principle operations for each system is being compared to get the better picture.

2.1   Overview of Related Works

Windshield wipers are the most important tools for vehicle drivers to allow them driving during rainy and snowy condition(Hashim et al., 2013). It's gives the

huge impact to the transportation system not only in our country but another country as well. Almost all motor vehicle's including car, aircraft and watercraft are equipped with wipers which are an essential requirment. When a device like windshield wiper is not provided in motor vehicle's, the possibility of the situation will become worse and dangerous to the safety of drivers and passengers. Among of the innovations that have been developed are based on Atmega328P, Arduino Board by using C programming language, Amplifier Circuit, Piezoelectric Effect (sensor) and Wiper Motor.

An innovation that will be introduced is the use of the Rain Sensor Effect (RSE) which is a sensor to detect rain with the measurements of rain intensity used (Application & Data, 1985). Atmega328P (microcontroller) will received signals from RSE through interfacing with the wiper control circuit and it is meant to control the wiper motor. The RSE is combined with the amplifier circuit control by the Arduino Uno Controller (Atmega328P) microcontroller. The benefit via this sensor is the ability of the signal to pass through objects, low cost and can transfer the signals in large ranges with help of the amplifier circuit.

Figure 2. 1: Rain Sensor Effect

Source : (Dharmadhikari et al., 2014)

2.2　Literature of Wiper System

2.2.1　Functional Requirements

The requirement of the wiper system is simple and easy to use. The windscreen should be kept clean so that the driver and passenger can have a perfect vision at all times. The wiper system must meet the following reqiurements :

    i.   Resistant to corrosion from acid, alkali and ozone

    ii.   Efficient removal of water, mist and snow

    iii.   Efiicient removal of any dirt

Good quality is very import for wipers and washing machine. The actual method used by the blades in cleaning the screen vary, providing the legally prescribed area of the screen is cleaned (Anthony E. Schwaller).
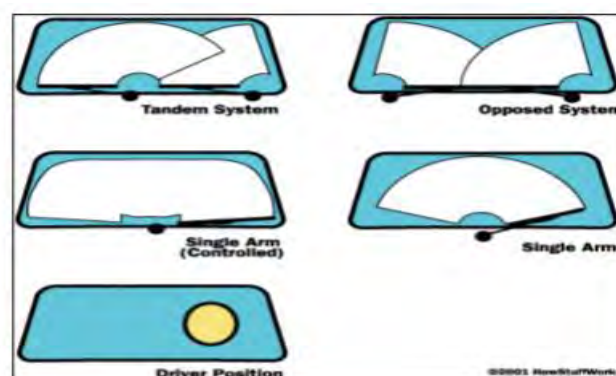

Figure 2. 2 : Windshield Wiper Technique

(Source : howstuffworks.com)

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