



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**AN INNOVATIVE AUTOMATIC SYSTEM DESIGN TO START-
UP ENGINE FOR PREHEAT SESSION USING
MICROCONTROLLER**

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 SYAHIR BIN CHE WAHAB

B071510837

931221-11-5625

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.....
 AHMAD ZAINAL TAUFIK BIN
 ZAINAL ARIFFIN

Alamat Tetap:
 318, Taman Sri Jaya, Wakaf Tembesu,
 21300 Kuala Nerus, Terengganu,

Cop Rasmi Penyelia

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Author : MUHAMMAD SYAHIR BIN CHE
WAHAB

Date: 07 **DISEMBER 2018**

APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

Signature:

Supervisor: AHMAD ZAINAL TAUFIK BIN ZAINAL
ARIFFIN

Signature:

Co-supervisor: OMAR BIN ASAROON

ABSTRAK

Automobil menjadi perkara yang mempunyai impak terhadap sistem pengangkutan bagi memudahkan masyarakat untuk urusan seharian. Masyarakat sering menggunakan kereta mereka pada awal pagi iaitu tatkala suhu enjin masih rendah. Situasi suhu enjin yang rendah ini mempunyai banyak perkara yang perlu dipertimbangkan untuk tempoh jangka hayat panjang seperti kelikatan minyak enjin, pengewapan minyak petrol dan geseran enjin. Keadaan ini boleh dikurangkan dengan memastikan enjin berada dalam suhu yang lebih sesuai dengan operasi enjin tersebut sebelum digunakan. Tujuan sistem “An Innovative Automatic System Design to Start-Up Engine for Preheat Session Using Microcontroller” adalah untuk membantu masyarakat mencapai keadaan enjin yang lebih baik sebelum digunakan menggunakan teknologi tanpa wayar. Hal ini dapat dilaksanakan untuk menghidupkan enjin tanpa memasukkan kunci kereta pada slot kunci sehingga enjin mencapai suhu enjin yang lebih baik. Kod dibangunkan menggunakan perisian Arduino bagi menghidupkan enjin dalam masa tertentu kemudian kod ini dimuatnaik ke papan Arduino. Perkakasan ini kemudiannya dicantumkan dengan sistem penghidupan enjin sedia ada dan mampu untuk menghidupkan enjin dalam masa tertentu. Sistem ini dibina dengan kos yang rendah bagi memberikan kelebihan kepada pengguna untuk mampu milik perkakasan ini. Sebagai konklusi, sistem ini mampu membantu enjin mencapai suhu lebih baik apabila masyarakat melakukan pelbagai aktiviti sementara menunggu enjin dipanaskan dengan kos sistem yang rendah.

ABSTRACT

Automobile become most significant transportation to assist community for their daily activities. The people tend to use their car in the early morning as the engine is still in low temperature mode, also known as cold start engine. The cold start engine has various things that need caution for prolong usage such as lubrication efficiency, fuel vaporization and engine friction. This behaviour can be counter measured by ensure the engine is at optimum temperature before used. The primary concern of “An Innovative Automatic System Design to Start-Up Engine for Preheat Session Using Microcontroller” is to people to achieve better level of engine temperature before used after certain period – after car engine shut down by wireless communication. People can do other activities while warming up their engine using this wireless technology. This can be done by auto-start the car even without the need of inserting keys in ignition switch slot until the engine reach the better temperature within flexible time. The code is developed using Arduino Integrated Developed Environment (IDE) software to trigger the ignition system in certain time then the code uploaded into Arduino UNO board. This hardware system design then integrated with car ignition system to achieve the purpose. As the result, the system successfully integrated with the car built in system and able to activate ignition system in certain amount of time then shut it down due to fuel usage. The system built is in range of low cost to manufactured hence this give great advantages for user to afford the system. The system conclude that the engine temperature can be at better condition while help people to do multitasking while warming up their car engine before use the car with low cost system design.

DEDICATION

This project and product designing work is dedicated to my beloved parents for their keen caring and love throughout my life, my loving siblings, my supervisor/co-supervisor and my friends for their encouragement and love. This project symbolizes a great memorial in my life for my supervisor, a mentor, a teacher and more like a brother to me who just passed away a day before presentation day. May he rest in blessed place.

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LIST OF SYMBOLS

I	Moment of inertia
l	Length
m	Mass
N	Rotational velocity
P	Pressure
Q	Volumetric flow-rate
r	Radius
T	Torque
Re	Reynold number
V	Velocity
w	Angular velocity

LIST OF ABBREVIATIONS

IDE	Integrated Development Environment
RPM	Revolutions per minute
IC	Internal Combustion
CI	Compression Ignition
SI	Spark Ignition
CO ₂	Carbon Dioxide
NO _x	Nitrous Oxide
HC	Hydrocarbon
CO	Carbon Monoxide
TDC	Top Dead Centre
BDC	Bottom Dead Centre
AFR	Air to fuel ration

CHAPTER 1

INTRODUCTION

1.1 Background

Automotive have various of system to achieve the purpose of the transportation itself. From earlier stage of creation of car, the car requires most significant system to move the car. The car needs to be operated by the engine and this engine works as an input to the powertrain. Gasoline engine have four stroke system – Intake, Compression, Power and Exhaust stroke. Starting with an assist from starter motor, this cycle initiated and thus manage to continue the revolution by itself. As for power stroke, the mixture of air fuel will ignite from the spark of plug which triggered from the distributor ignition arrangement. To allow the engine to be started, the system requires the current flow from the battery supply to the ignition coil and starter for cranking purpose so that the engine might be started. The purpose of ignition system is to generate a very high voltage from 12V battery supply and send this supply to each spark plug to ignite the fuel-air mixture in engine combustion chambers. “An Innovative Automatic System Design to Start-Up Engine for Preheat Session Using Microcontroller” is to assist the level of engine temperature before used after certain time – after car engine shut down. This can be done by auto-start the car even without driver until the engine reach the optimum temperature within flexible time. This project also involving few aspects of car including analysis of cold engine start, fuel consumption of idle speed engine, emission by idle engine and lubricant effect.

1.2 Statement of the Purpose

The purpose of the research is to create innovative system to initiate engine start up for preheat session in certain amount of time using microcontroller.

1.3 Problem Statement and Objectives

People need to reduce their time to wait before using their automobile in most efficient way. Time management is significant issue for some people, including car performance and maintenance. To achieve best performance and giving longer lifespan to the automobile, the user must use their car in most suitable condition. Aim of this project is to provide the user with optimum engine condition when the car about to used. The objectives of this project are:

1. To design the system which provide the automatic engine start up before user enter the car.
2. To create the programming code to stimulate the ignition system.
3. To install microcontroller hardware with program into car ignition system and activate ignition system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, the analysis of engine cold start analysis is enclosed to understand and attain the information on the technology available and the approaches used for their scheme on the similar subject. This section will be attentive on the data of the study and the system development to complete the project. This information then will be used as the parameter to find the utmost appropriate system based on the factor and the supported concept to finalize the design based on the scopes of the project. The literature including most important factor for the idea and purpose of the project. The main input for the project is understanding of the engine and its maneuverer, cold start analysis, its friction and fuel consumption and the microcontroller.

2.2 Internal Combustion Engine

The piston engine is acknowledged as an internal-combustion engine heat engine. The idea of the piston engine is to burn the stream of air-and –fuel mixture which is compressed before flow to inside of engine cylinder. This internal combustion issues heat energy which is then commute useful mechanical work as the high gas pressures generated force the piston to slip its stroke in the cylinder.

The crankshaft rod converts the piston movement thrust linear motion in cylinder to rotational movement motion. The piston act in backwards and forwards movement,

considering the restraints of the crankshaft crank-pin's rotary track and the cylinder.
[Johansson, E., Wagnborg, S., 2014]

2.2.1 Engine Operation

The process of a four-stroke, spark ignition (SI), Otto gasoline engine can be divided into numerous key stages. The piston has to meet four strokes to complete the cyclic thermodynamic process. Figure 2.0 shows a typical cylinder mechanism.

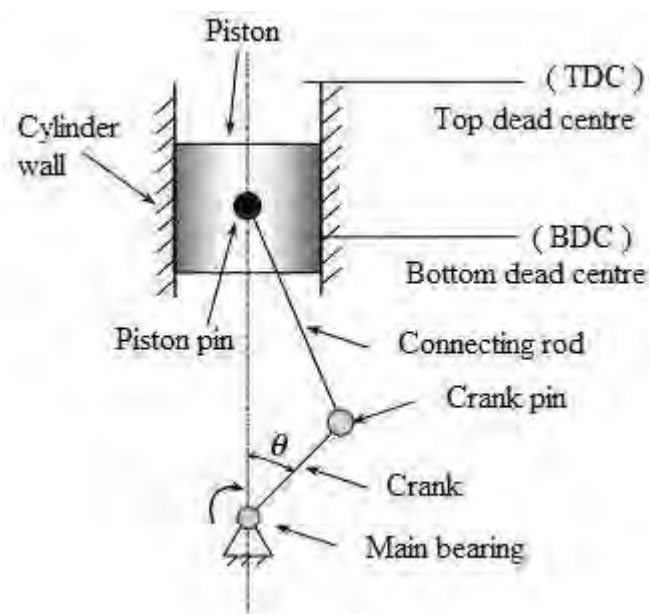


Figure 2.0: Cylinder piston mechanism

Each complete operation involving two crankshaft revolutions. During each crankshaft revolution, there are two strokes of the piston and a total of four strokes as shown in Figure 2.0.

a) Intake Stroke. The intake valve is opened, and the piston moves downward the cylinder and lures in an urge of air (or an urge of premixed fuel and air).

b) Compression Stroke. Both valves are closed, and the piston travels upward the cylinder. As the piston approaches Top Dead Centre, Spark Ignition occurs.

c) Power Stroke. After the spark ignites and the mixture is burnt, thus raising the pressure and temperature which thereby forcing the piston moving downward. At the end of the power stroke, the exhaust valve opens.

d) Exhaust Stroke. The piston travels upward the cylinder as exhaust valve remains open. The residual gases are removed. At the end of the exhaust stroke, the exhaust valve closes.

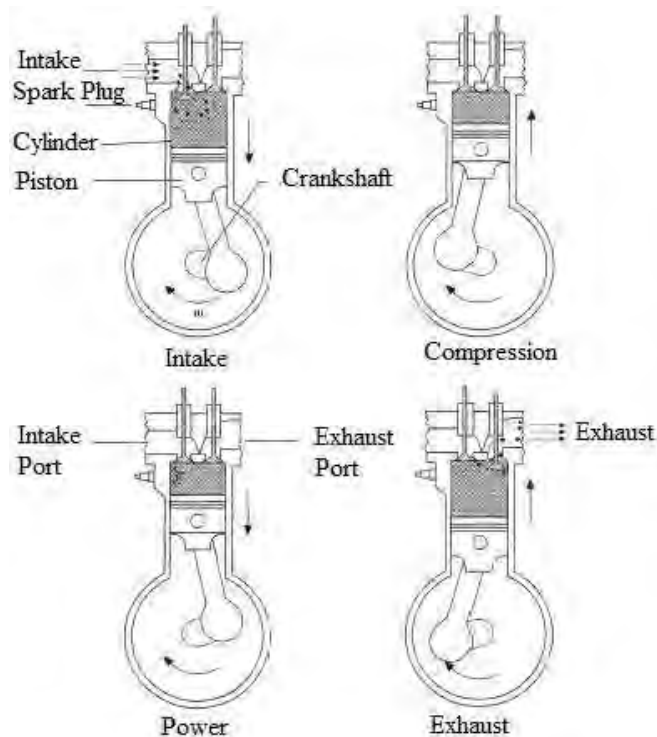


Figure 2.1: Four strokes of the engine [Heywood, J. B., 1988]