



Solenoidal Valve Actuation System for Four Stroke IC Engine

Vivek Gurve¹
gurvevivek@gmail.com

Larwin Ukey²
lukey358@gmail.com

Lokesh Nagtode³
lnagtode@gmail.com

Amit Meshram⁴
amitmashram095@gmail.com

Anup Naktode⁵
nagktodeanup@gmail.com

Sudhanshu Gaikwad⁶
sudhanshubg1998@gmail.com

Gyanprakash Yadav⁷
gyanprakashyadav1996@gmail.com

Hemant Bansod⁸
hemantbansod@sbjit.edu.in

^{1,2,3,4,5,6,7}Scholar Mechanical Engineering,

⁸Assistant Professor, Mechanical Engineering,

S. B. Jain Institute of Technology, Management and Research, Nagpur, India

Abstract— There is a huge competition between manufacturers to make advancement in engine technology. However, one component has stayed unaltered in the internal combustion engine advancement i.e., the camshaft has been the essential methods for controlling the valve actuation and timing, and therefore impact the overall performance of the vehicle.

The issue in utilizing camshafts is being significant power wastage in accelerating and decelerating the parts of the valve train. The friction of camshafts, springs, cam belts and so on, likewise denies us of valuable power and declines efficiency not to mention contributing to wear and tear.

It is a well-known fact that in the event that valves could be controlled autonomously in an Internal Combustion Engine, at that point there would be benefits like increase in power output, decrease in emission, and significant increase in efficiency. Camless innovation is catching the fate of internal combustion engines. In Camless technology valve movement is actuated and controlled by actuators of the electro-mechanical, electro-hydraulic and electromagnetic type.

Index Terms— Microcontroller, amplifier, motor driver, voltage regulator IC7805, relay circuit, led display

I. INTRODUCTION

A. Project Background

History appears that the thought of a cam-less inner combustion motor has its beginnings as early as 1899, when plans of variable valve timing surfaced. It was proposed that free control of valve incitation might result in expanded motor control. More as of late, in any case, the center of expanded control has broadened to incorporate vitality reserve funds, contamination lessening, and reliability. To give the benefits recorded over, analysts all through the past decade have been proposing, prototyping, and testing unused adaptations of valve incitation for the inside combustion motor. Their

plans have taken on a assortment of shapes, from electro-pneumatic, electro-hydraulic to electro-magnetic.

. In spite of the fact that a noteworthy numbers of motor valve-actuation frameworks counting cam-based and cam less components have been as of now presented by a few inquires about and companies, as it were few sorts of these frameworks (primarily cam-based) have been utilized on commercial vehicles due to the risk, solidness and taken a toll issues. Cam-based valve frameworks offer solid and tough usefulness, the cam less valve trains can shift valve lift and more timings to a more prominent degree comparing to the cam-based sorts. Among different categories of cam less components, the electromagnetic actuator framework is the foremost wanted one.

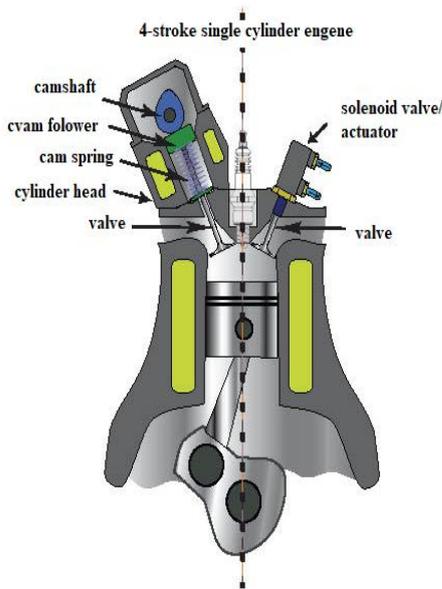


Fig.1: Conventional Engine Vs Camless Engine

B. Problem Statement

In customary IC motors, valve uprooting could be a settled work of crankshaft position. The valves are incited by cams found on a belt- or chain-driven camshaft, and the shape of these cams is decided by considering a trade-off between motor speed, control, and torque prerequisites, as well as vehicle fuel consumption. This optimization comes about in .a motor that's profoundly proficient as it were at certain speeds. Another issue in utilizing camshafts is being noteworthy control wastage in quickening and decelerating the parts of the valve prepare. The grinding of camshafts, springs, cam belts and so on. Moreover denies us of profitable control and decreases productivity not to say contributing to wear and tear.

C. Purpose of Study

Although the ordinary framework has demonstrated to be helpful and secure. Its settled valve timing is fundamentally a compromise of combustion soundness, fuel economy and most extreme torque goals. Cam is a necessarily portion of a motor because it controls valve activation which in turn is capable for supply of air-fuel blend into the combustion chamber and for the expulsion of deplete gasses from the combustion chambers. The

reason of this think about is to survey the improvement in cam innovation in chronological arrange, asses the disadvantages of the current innovation and plan and create an electro-magnetic valve incitation framework to supplant the current cam adherent framework and its drawbacks.

II. CAMLESS ENGINE OVERVIEW

Main sensors

- Engine load sensor
- Exhaust gas sensor
- Valve position sensor
- Engine speed sensor



A. ATMEGA 16 Microcontroller

All output alerts generated from flex sensors are in analogue shape and those alerts need to be digitized before they can be transmitted to encoder. Therefore microcontroller ATMEGA sixteen is used as the primary controller in this venture.



Fig.2: ATMEGA 16

It has inbuilt ADC module, which digitizes all analogue alerts from the sensors and in-built multiplexer for sensor sign choice. It helps both serial and parallel communication centers.

Atmega16 is an eight-bit high overall performance microcontroller of Atmel's Mega AVR circle of relatives with low power intake. Atmega16 is based on stronger RISC (Reduced Instruction Set Computing) structure with 131 effective commands. Most of the commands execute in a single gadget cycle. Atmega16 can work on a maximum frequency of 16MHz.

ATMEGA sixteen devices are available in 40-pin

- It is eight-bit Microcontroller
- System is RISC Architecture
- It has Small set of Instruction set
- It has 131 powerful Instructions
- Compatibility avail 28/forty Pin Ics
- Operating Speed Max 16 MHz, Voltage 2-5.5 v
- It has four 8 bit Ports distinct as PORT A,PORT B,PORT C, PORT D for Internal and External utilization.

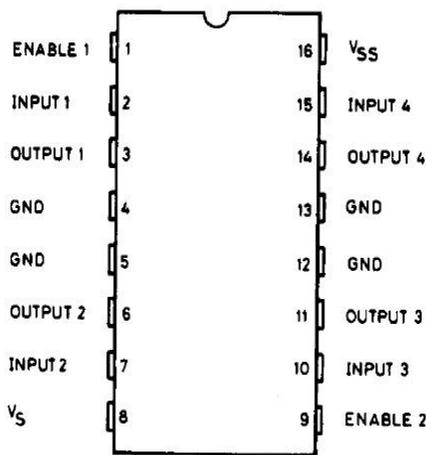


Fig.3 : Pin out diagram of ATMEGA 16

B. 7805 Voltage Regulator IC

The 7805 voltage regulators appoint built-in contemporary limiting, thermal shutdown, and safe-running place protection which makes them actually immune to harm from output overloads. 7805 is a 3-terminal fine voltage regulator.

- With good enough heat sinking, it could supply in extra of zero.5A output cutting-edge. Typical programs might encompass nearby (on-card) regulators which could eliminate the noise and degraded overall performance related to single-factor regulation.
- 7805 ICs have three terminals and are maximum typically discovered inside the TO220 shape issue, although smaller floor-mount and large TO3 applications are also available from some producers. These gadgets typically support an enter voltage which may be everywhere from multiple volts over the intended output voltage, as much

as a maximum of 35 or forty volts, and can typically provide as much as around 1 or 1.5 amps of modern.



Fig.4 : 7805 voltage regulator IC

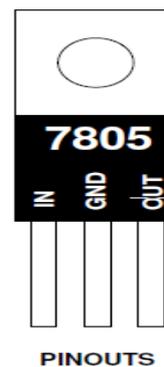


Fig.5 : Pin out diagram of 7805 IC

B. C. LCD 1602ZFA

Features

- Sixteen x 2 Character LCD.
- five x eight dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/sixteen responsibility cycle
- B/L to be pushed with the aid of pin 1, pin 2 or pin 15, pin sixteen or A.K (LED)
- N.V. Non-compulsory for + 3V energy deliver

TABLE 1

MECHANICAL DATA OF LCD 1602ZFA

MECHANICAL DATA		
ITEM	STANDARD VALUE	UNIT
Module Dimension	80.0 x 36.0	mm
Viewing Area	66.0 x 16.0	mm
Dot Size	0.56 x 0.66	mm
Character Size	2.96 x 5.56	mm

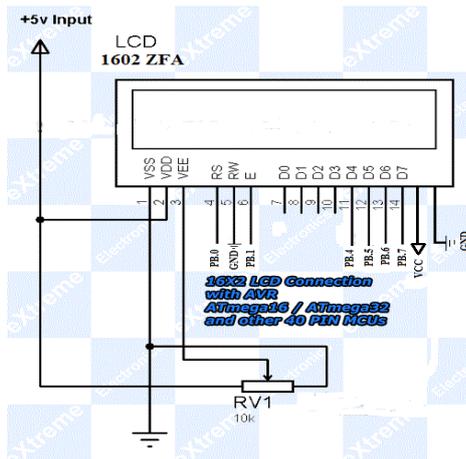


Fig.6 : LCD 1602ZFA

D. L293D Relay/Motor IC

L293D IC is basically used for riding the inductive loads like DC automobiles, stepper motors, and relays. It is a 16 pin DIP IC .It will simply make bigger the logical input combos from the microcontroller IC to power the inductive hundreds like DC motor in our case.

With the assist of L293D IC we are able to drive two vehicles concurrently at a time. It has four I/P pins and 4 O/P pins for controlling the devices by the usage of microcontroller. For a unmarried motor the combinations of I/P are used for taking the I/P from the microcontroller and after amplification the corresponding O/P mixtures are connected with motor.



Fig.7: L293D Relay/Motor

III. SOFTWARE USED

PCB's are the spine of any production level electronic tool in today market, and therefore expertise of PCB layout equipment can be a essential talent. Both analog and digital circuits are utilized in PCBs depending on the utility, and with special varieties of circuits, the

dressmaker must keep in mind sure design considerations. This guide will show you a way to make a simple PCB format with virtual components, and the design considerations that come with it. More Advance circuits like RF circuits or Power circuits take extra thought inside the format and design due to the fact the circuit is extra touchy to aspect placement and the lengths of the connections among them.

A. Program

```
#include<avr/io.h>
#include<util/delay.h>
#include<teextra.h>
main()
{
  lcd_init();
  init_adc();
  int x,a=1;
  DDRC=0b11111111;
  PORTC=0b11111111;
  while(1)
  {
    x=read_adc(0);
    _delay_ms(51);
    lcd_clrscr();
    lcd_goto(0,1);
    lcd_printi(x);
    _delay_ms(500);
    if(x<200 && a==1)
    {
      a=2;
      lcd_clrscr();
      lcd_goto(0,2);
      lcd_prints("Suction");
      _delay_ms(50);
      PORTC=0b10111110;
      //PORTC=0b01000001;
      _delay_ms(5000);
      _delay_ms(5000);
      _delay_ms(5000);
    }
  }
}
```

```

_delay_ms(2000);
//PORTC=0b00000000;
PORTC=0b11111111;
_delay_ms(50);
//PORTC=0b00000010;
    PORTC=0b11111101;
lcd_clrscr();
lcd_goto(0,2);
lcd_prints("Compression");
_delay_ms(50);
    _delay_ms(2000);
    _delay_ms(5000);
    _delay_ms(5000);
    _delay_ms(5000);
//PORTC=0b00000000;
PORTC=0b11111111;
_delay_ms(50);
}
}
if(x>200 && a==2)
{
    a=3;
    //lcd_clrscr();
    //lcd_goto(0,2);
    // lcd_prints("Down");
    // _delay_ms(50);
}
if(x<200 && a==3)
{
    a=4;
    lcd_clrscr();
    lcd_goto(0,2);
    lcd_prints("Ignition");
    _delay_ms(50);
//PORTC=0b00000000;
PORTC=0b11111111;
    _delay_ms(5000);
    _delay_ms(5000);
    _delay_ms(5000);
    _delay_ms(2000);
    lcd_clrscr();

```

```

lcd_goto(0,2);
lcd_prints("Exhaust");
_delay_ms(50);
    //PORTC=0b10000000;
    PORTC=0b01111111;
    _delay_ms(5000);
    _delay_ms(5000);
    _delay_ms(5000);
//PORTC=0b00000000;
PORTC=0b11111111;
    _delay_ms(50);
}
if(x>200 && a==4)
{
    a=1;
}

```

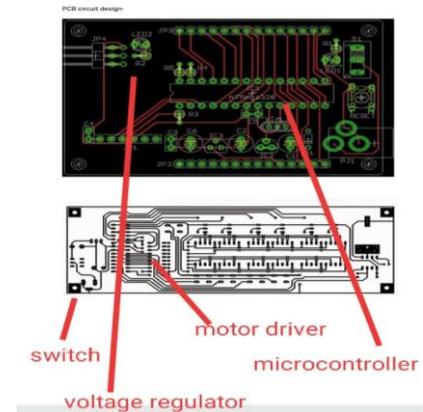


Fig8: Circuit diagram



Fig9: Solenoidal Valve Actuation System for Four Stroke IC Engine

IV. ADVANTAGES

1. Enables the improvement of higher torque all through the whole rev run which in turn makes strides fuel economy
2. Cylinder Deactivation can be accomplished amid the sitting phase
3. Exhaust gas distribution is improved
4. Reduces contact losses
5. Reduces the idleness of moving parts

A. Resultant Advantages

1. Lower deplete outflows- EGR framework is killed since EGR impact happens on its possess & hence diminishes NOx emissions
2. Reduction in estimate & weight •
3. The result is 47 percent more torque, 45 percent more control, 15 percent less fuel and 35 percent less outflows from an motor that's too littler, lighter and cheaper to fabricate.
4. Better fuel economy- 15 to 30% increase
5. Higher torque & control- 40 to 47% increase

V. CONCLUSION

This project has the application of knowledge of engineering fundamentals such as valve timing, thermal efficiency of engine, Electromagnetism, PCB Design and programing which enables to find solution of problem.

This project has complete background study of the evolution of background study and data analysis was done in chronological order. This model was designed to make an attempt to overcome the drawback of cam based engine. The project includes design of the proposed solenoid valve actuator for 4 stroke IC engine. This design can be extended to multi cylinder engine where its true potential can be experimentally tested.

Modern tools such as AVR Studios, PCB Artist, Matlab and CF Toolbox was used for designing of model.

The project has taught to apply ethical principles such as Intellectual property rights /Code of conduct in research/ confidentiality of information/use of ethical

resources etc. The project being a group project, has taught to effectively work as an individual and as a leader.

The project/course work has taught how to effectively communicate with engineering community/society. The project report and its delivery have upgraded the skills script report and to make effective presentation.

The principle of project management was applied during the course of entire project work. The project has enhanced the skills to recognize the need of the society/Profession and prepares /engages oneself in lifelong learning to meet the future demands and to improve the effectiveness engine.

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