CONSTANT CURRENT CONTROL USING PWM TECHNIQUE FOR HHO GENERATOR

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Abstract— We are evidenced to world climate change where energy consumption is the major cause of this situation. Technology should accelerate potential use of emerging trends and create opportunities to shift world on sustainable path. Carbon emission from internal combustion system should be reduced considerably and Usage of hydrocarbon fuels should be optimal in such a way that there should be little emission of carbon-monoxide (CO), Sulfur oxide (SOx), nitroxide (NOx)
Renewable energy is not completely replaced the oil energy. In current situation oil majorly used in road transportation where effective use of hydrocarbon fuel is not upto mark, reason for this may be due to under combustion of hydrocarbon fuel. Boosting mechanism to improve the fuel combustion is very much required. In this paper we proposed injection of oxyhydrogen [HHO] to the engine in a controlled manner by using constant current control using PWM technique to enrich fuel mixture which undergoes complete combustion and result in cleaner emission and also improve the efficiency of IC engine.

Keywords—HHO generator, Electrolysis, constant current control, PWM.

I. INTRODUCTION

Depletion of fossil fuel [1] due to increase in energy consumption rate of oil and sharp reduction of oil production gives alarm for optimum use of fossil fuels. Considerable amount of Energy loss in ic engine due to improper combustion hydrocarbon fuel. Overall efficiency is around 56% in diesel engine and much lower for gasoline engine [2] Emission coming out of exhaust engine consists majorly NOx with a rate of more than 50 % secondly particular matter and small portion of SOx [3]
Effective combustion when hho is used
Effective generation of hho gas through electrolysis process
PWM method impact

II. EASE OF USE

A. HHO GENERATOR

When current passing through water which consists of small portion of KOH or NaOH ions in a electrolyte solution and in the process atom holding bond will be broken in order to release oxygen and hydrogen in the water molecule form. Electrolysis processes is governed by equation
$2\ H_2O(l) \rightarrow 2\ H_2(g) + O_2(g)$
Assuming constant temperature and temperature for both the gasess the production of hydrogen gas is twice the oxygen.

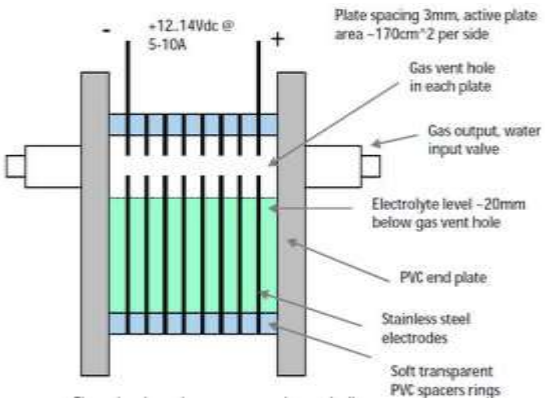

Fig:1 construction of hho generator

B. Working of HHO GENERATOR

Hydrogen HHO generators use electricity from the vehicle's battery to create hydrogen from water while driving. The HHO is never stored. As soon as it is generated, it gets injected into the engine where it mixes with the existing fuel. The resulting mixture burns more efficiently, reducing fuel consumption and the amount of pollutants released in the air. This innovative Automotive Hydrogen on Demand technology decreases fuel consumption by 20%-60% and offers significant reduction of NOx, CO, CO2 and HC emissions. The hydrogen explosion is so fast that it fills the combustion cylinder at least 3 times faster than the gasoline explosion and subsequent ignites the gasoline from all directions (it is like putting fire on a fule), instead of just a spark in one end of the combustion cylinder, and we would like to do that because the gasoline only has a short time in the combustion cylinder and if it is not fully burnt in that short amount of time then it just goes out of the exhaust and is lost. It is also preferable to ignite all of the gasoline when it is under maximum compression in combustion cylinder to get the maximum amount of energy out of it (this is a small time window), once the piston starts going down the energy transfer from the explosion to the

Fig 2: working of hho generator.

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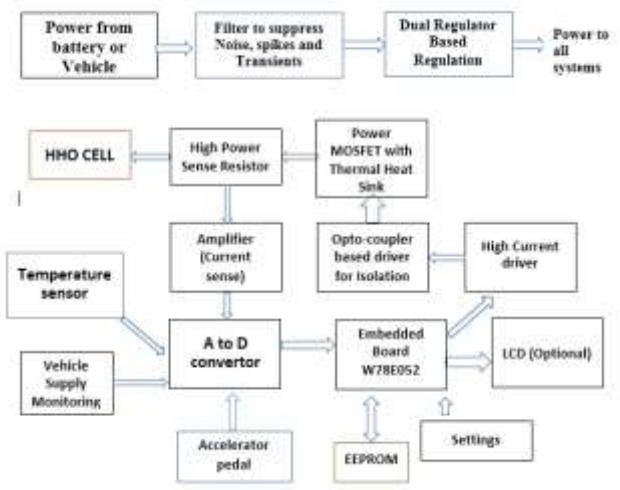
III.



A. *Power supply*

Power It is generally taken from combination of alternator and battery, i.e. it should ensure that when alternator is on that time only power should be given to HHO otherwise battery will be loaded and life of the battery will become less, so a special alternator one sense circuit can be added to do this and system will work if alternator current is present or in other words vehicle is in running mode.

Alternator power is not pure and it has noise and spike and during high load demands like electric starting vehicle high transients are seen, all of above can create problem in digital systems so we need to block these and filter power and then regulation is done. Here we do dual regulation to limit the power dissipation on one regulator, hence power dissipation is divided among two regulator.

B. ***Embedded board***

It is the brain of the system. It controls the constant current using PWM method now MOSFET is driven by this PWM pulses as to isolation of digital system and high power system so we used Opto-isolator.

Opto-isolator is driven using high current driver as embedded system, current sink and source capacity is limited. Here we are using W78E052 which is very advance version of basic 8051 microcontroller and for this chip programmer is not required since it has inbuilt bootloader, so during R&D loading program again and again is easy and later on final code can be programed in equivalent low cost chips.

C. *Power mosfet*

It should be able to handle high current, and current control is done by PWM signal driving its gate. For thermal management heat sinks can be employed on MOSFET and regulators. Currently we decided to use IRFZ44 for our purpose.

D. *Sense resistor*

To control the current we need feedback or we need to monitor current. This sense resistor is used for that its low value high power resistor. Parallel to this resistor we connect an amplifier and convert voltage drop across this resistor as input, this voltage is proportional to current flowing in resistor. Being of low values drop is also low hence amplification is required.

Amplified output is given to A to D convertor and digitized output is used by microcontroller. If current rises then set limit then PWM is decreased and if current is lower then set limit PWM is increased.

IV. IMPLIMENTATION

Constant current supply design using PWM method project has two important part: Current sensor design which is discussed in last chapter and PWM on/off control of load using microcontroller and MOSFET. In previous chapters we have understood working of opto- coupler, high current driver and MOSFET. Here MOSFET is used a switch device and the gate of MOSFET is controlled via opto-coupler. When opt-coupler is on the photo transistor will switch of the MOSFET as voltage at the gate will be zero and when opto-coupler is off that time gate will get VCC via 1K resistor as photo transistor is off. Opto-coupler is driven by high current driver ULN2003.

LCD is used to display current, voltage and PWM, in this project we have connected LCD data bus to port 1 and its control pins EN and RS to pin(p) 3.4 and p3.5. IIC Bus is made using p3.6 and p3.7 for clock and data lines of IIC protocol bus. On this bus we have connected clock and data pins 9 and 10 of IIC ADC PCF8591, two channels of this ADC are used one for current monitoring and other for voltage monitoring, p2.0 is used for controlling MOSFET on/off via opto-coupler and ULN2003, p0.7 is used to get feedback from current sensor if this pin is high then PWM is decreased and if this pin is low then PWM is increased. LM7805 regulated the input dc supply 5v for all IC and VCC supply requirements.

We have extensively tested our circuit and code using different dummy resistive load and we noted down current reading and also seen wave form on CRO.

A. *Result and conclution*

By this constant current system the amount of HHO gas generated by the HHO cell can be controlled. This system is an universal product for any other load and not only for HHO cell. This constant current system can be used in various other places wherever constant current is required. By maintaining constant current to HHO cell, the amount of gas required for the particular vehicles can be controlled and the efficiency of the vehicle is increased.

TABLE I. TABLE TYPE STYLES

	Table Column Head			
	Table column subhead	***Subhead***	***Subhead***	
Sl no	LOAD RESISTANCE IN OHMS	**CURRENT IN AMPERES(WITHOUT OUR SYSTEM)**	**CURRENT IN AMPERES(WITH OUR SYSTEM)**	**PWM (%)**

	Table Column Head			
	Table column subhead	*Subhead*	*Subhead*	
1	38.05	0.27	0.28	90
2	31.97	0.32	0.29	70
3	13.5	0.43	0.32	65
4	16.5	0.62	0.31	40
5	10	1.03	0.28	35
6	5	2.06	0.28	20

[a.] Sample of a Table footnote. (*Table footnote*)

Fig. 1. Example of a figure caption. (*figure caption*)

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