REDUCTION OF FUEL CONSUMPTION IN ENGINES USING HHO GAS

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ABSTRACT

In the past few years automotive companies have been searching for an intelligent device to increase fuel millage in order to protect the environment. The foundation to develop an intelligent device is based on the source input. Brown gas (HHO) has been recently introduced to the auto industry as a new source of energy. The present work proposes the design of a new device attached to the engine to integrate an HHO generator with the gasoline engine and also to regulate the flow of gasoline with respect to oxygen sensor. There are two major phases: The first phase is designing of HHO generator which is related to the electrochemical engineering and second phase is designing of an electronic circuit which regulates the flow of gasoline with respect to Oxygen sensor. The proposed HHO generating device is compact and can be installed in the engine compartment itself. From this design the fuel utility is reduced from 15% to 30%. It also improves the efficiency of the engine by increasing the engine torque. This system also helps in reducing the pollution and maintaining the green house effect.

Keywords: Electrolyte, Fuel Cell, PWM.

I. INTRODUCTİON

With such high demand for more efficient engines, our mission is to design and create a device that will increase engine efficiency without loss of its performance. Such device is known as HHO generator. This generator uses electric current (electrolysis) to produce hydrogen from water; the hydrogen will be introduced into the combustion chamber of an engine via intake manifold. We have made it compact and affordable. It is mandatory that the amount of energy put into the cell to split the water molecules is less than the amount of output energy of the generator. In order to overcome this challenge we had made it as efficient as possible. This includes coming up with a creative design to get maximum hydrogen out with the least amount of current running through the cell. Taking these aspects into consideration we will make the HHO generator as a productive addition to any internal combustion engine.

II. LITERATURE SURVEY

Water electrolysis is one of the most clean, simple, and intuitive procedures to yield [5]hydrogen. Such process, discovered by M. Faraday in 1820, [1]consists of decomposing water into its constitutional components known as oxygen and hydrogen by means of electric current. The process of electrolysis works with an electrical power source that is connected to electrodes that are made out of typical metal (such as stainless steel, platinum or, titanium), which are submerged in water enhanced with electrolytes. Hydrogen [6] will be produced at the negatively charged electrode (cathode), while oxygen will be produced at the positively charged electrode (anode). In past similar such schemes were developed for power generation. As per literature survey Invivo power generation using Micro solid oxide fuel cell stacks have been proposed. It consists of Hybrid self sustaining system for power generation. It was initially used for powering IET Indian summit, Kolkata in 2013. There was an alternate technique called Oxygen Ion Transport to the electrolyte solid oxide fuel cell was implemented in ICRERA [3]. This were some of the fuel cell techniques which were implemented in past. Also there was an Multifuel model of Oxygen and Ion transport fuel cell presented in 8th WSEAS International conference [4]. This model was equipped with supplementary fuels like Traditional fuels, Biomas [2] Fuels, Nanobiomous fuels, Wasted Body Fluid Fuels etc. for Invivo support. Similarly literature also describes (Proton Exchange Membrane) PEM fuel cell technology based on the existing principle of HHO.

III. PHASE 1: PRINCIPAL OF ELECTROLYSIS

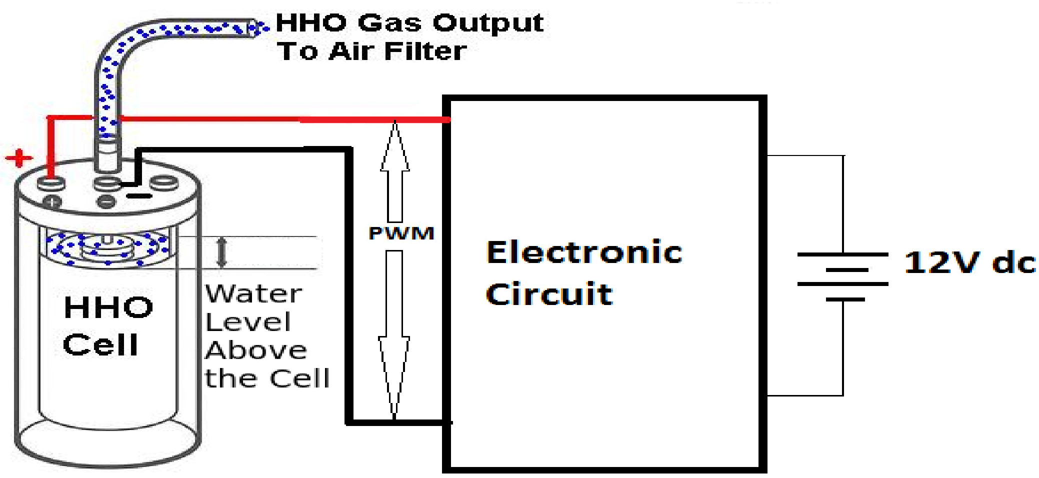

Fig. 1. HHO generator

Fig. 1 shows The wet cell system based on electrolysis. The process of electrolysis works with an electrical power source that is connected to two electrodes that are made out of typical metal (such as stainless steel, platinum or titanium) which are submerged in water enhanced with electrolytes. Hydrogen will be produced at the negatively charged electrode (cathode), while oxygen will be produced at the positively charged electrode (anode). The adjoining electronic circuit will generates a PWM signal and this signal is connected to the electrode. More the potential of the cathode will release the maximum hydrogen whereas more the potential of anode will release maximum oxygen. This way the generation of HHO takes place.

3.1 PWM Generation

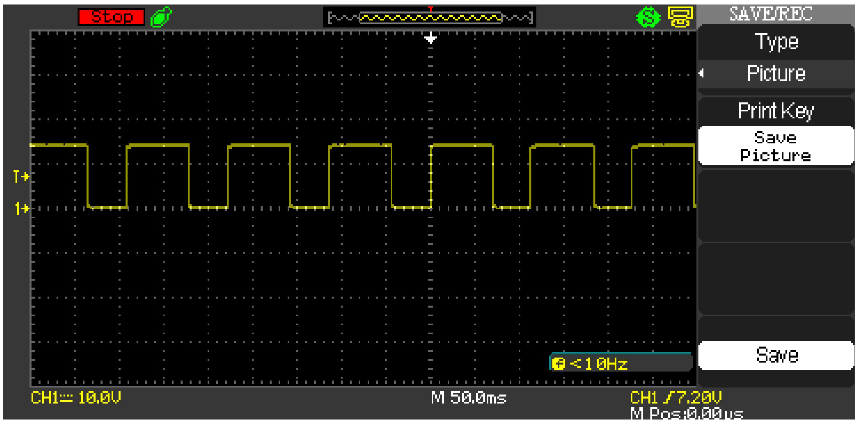

Fig. 2. PWM Generation

PWM is needed for observing and maintaining the amperage flow of the HHO electrolyzer. And, it is nice to be able to control the output of your hydrogen generator from your dashboard. During winter months, we need more electrolyte in the water because cold water does not conduct electricity as well. In summer months, we need less electrolyte in the water because hot water conducts electricity much better than cold water. During periods of mixed hot and cold, PWM is mandatory for HHO generation. The PWM allows you to use more electrolyte, but still control the output of the HHO generator. The purpose of the PWM is to pulse the DC voltage to the cell. Pulsing the voltage switches the current between high and low levels, thus reducing the heat caused by constant electron flow. In other words, just as the current starts to flow, it gets stopped. The series of starts and stops happen instantaneously. In addition, the PWM allows you to regulate the amperage (current). This provides runaway control over the cell. The longer the cell runs on DC, the hotter the water will get; the higher the amps will go.

3.2 PWM Features

- Maximum Continuous Amperage Output, not Maximum Amperage. This is the maximum amperage the PWM can be operated at constant long periods and not short operating periods.
- Automatic Current Limiting, Constant Current (CC). This allows you to set the Amperage Output to a specific amperage. The PWM then will maintain that amperage, regardless of the water temperature.
- Adjustable Pulse Frequency. This allows you to adjust the time between pulses. Fast pulsing causes more heat than slow pulsing. Pulsing turns the cell on and off rapidly; as rapid as you set the frequency.
- Duty Cycle Adjustment. The duty cycle reading lets you know if your electrolyte fluids are too weak or too strong as the duty cycle of an automatic current limited PWM will be approximately 70% when the Cell is warmed up(depending on your Cell design). If it is significantly higher, you know you have too little electrolyte and if its significantly lower, you have too much electrolyte. If the Cell is cold, the current should be at or very close to the set limit (duty cycle will be approximately 100%).

IV. PHASE 2: GASOLINE REGULATION

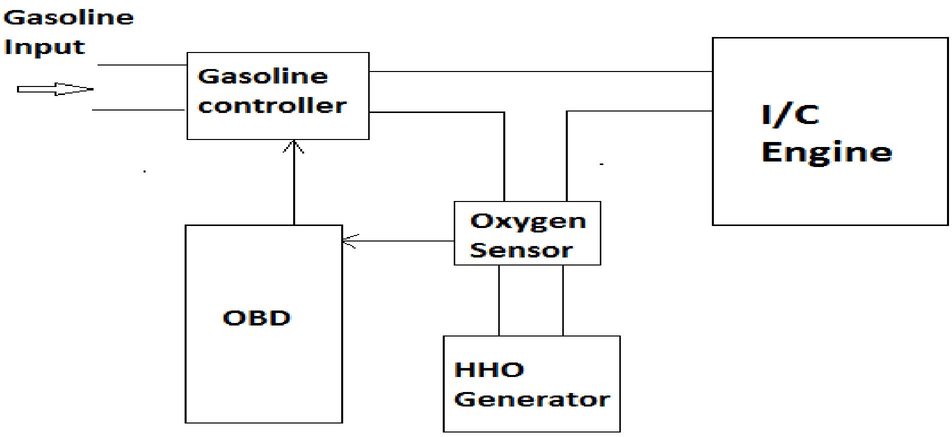

Fig. 3. Gasoline Regulation

In this phase of the proposal we are regulating the flow of gasoline with respect to an oxygen sensor. As illustrated in the Fig. 3 above we can observe that there is one oxygen sensor connected to HHO generator via OBD and gasoline controller.In this approach the OBD is used to generate the control signal for the gasoline control. The OBD has the input of oxygen sensor and depending on that input there is one inbuilt algorithm which will provide the control signal for the gasoline controller. So basically by this approach we are managing the gasoline consumption with the substitute of HHO and the engine is efficiently operated. For safety reasons it is important to use an apparatus called bubbler between the HHO generator and the intake of the car. The bubbler is closed container full of water that will help us to avoid any condensed leftover liquid to get into the engine, as well as any back fire from the engine to enter our generator because back fire may cause an explosion.The average gasoline engine in a car is about 18% to 20% efficient. That leaves a lot of scope for improvement and Brown gas is one good way of improving the efficiency. As we know that the hydrogen is highly flammable much more than gasoline so when your engine ignites the hydrogen the explosion ignites the gasoline with much better results (cleaner, less waste and fewer emissions).

V. HEALTH AND SAFETY CONSIDERATIONS

- **HEALTH:-** Vehicles that currently use internal combustion engines to burn diesel or gasoline fuel will need to replace with new fuels that are less scarce and burn cleaner, reducing or even eliminating the possibility of pollution and keeping away harmful gasses that can affect consumers health. Before we extinguish fuel like petrol and diesel, we have to find alternatives for them. Hydrogen is one of the best alternative to it.
- **ENVIRONMENTAL IMPACT**:- Since the industrial revolution started, the environment had experienced some changes which are irreversible. All the exhaust gasses emitted by factories, coal power plants, aeroplanes, vehicles, etc are heating up the planet and are causing the ozone layer to damage. Such phenomenon is changing the global temperature of the planet. We have to look for ways to reduce these emissions and try to slow down the global Warming and stop the ozone layer from depleting. This paper is aimed to find a way to alleviate the fuel consumption implementing an HHO

generator. The Implementation of one single HHO generator will not help the environment much. However, we are hopeful that devices such as this one will become a trend. Not only they will save money, but they will help the environment by consuming less gasoline and they will also emit less harmful gasses.

- **SAFETY:-** Using hydrogen as a fuel supplement for combustion engines in cars introduces certain potential safety hazards for consumers. Hydrogen is an odorless, tasteless, colorless, and highly flammable gas. In comparison with gasoline, hydrogen has higher flammability. Storage of hydrogen gas under high pressure introduces hazards to nearby personnel in the event of a loss of containment from material failure, so therefore choosing the correct materials is the key to properly maintain he tolerance required. Hydrogen is a flammable substance that requires care and should be handled with care.

Frequency of PWM = 20Hz.

Sr. No.	% duty cycle	Gas ml	Gas in gallons	Time in min
1	60	20	0.0053	15
2	70	26.5	0.0070	30
3	80	28.3	0.0075	40

Table I Observation Table For Hho Generation

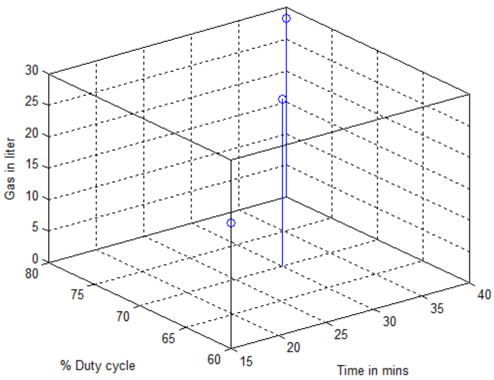

Fig. 4. Plot For HHO Generation

Table I shows the readings for the HHO generation. Here we have kept the frequency constant at 20Hz and duty cycle of the PWM signal is varied with respect to time.The corresponding gas genetration is tabulated.Also the plot shown in Fig.4 describes the process of HHO generation graphically.

VII. APPLICATIONS

- Lighting: Many forms of ox hydrogen lamps have been described, such as the limelight, which uses an ox hydrogen flame to heat a piece of lime till white hot incandescence. Because of the explosiveness of the ox hydrogen, limelight's have been replaced by electric lighting. In Nineteenth century, bellows-operated oxy-hydrogen blowpipe which includes two different types of flashback arrestor. The ox hydrogen blowpipe was developed by English mineralogist Edward Daniel Clarke and American chemist Robert Hare in the early nineteenth century. It produced a flame hot enough to melt such refractory materials as platinum, porcelain, fire brick, and corundum, and was a valuable tool in several fields of science. It is used in the Verneuil process to produce synthetic corundum.

- Oxyhydrogen torch: An oxyhydrogen torch is an oxy-gas torch, which burns hydrogen with oxygen. It is used for cutting and welding metals, glass, and thermoplastics. Due to competition from the acetylene-fueled cutting torch and from arc welding, the oxyhydrogen torch is seldom used today, but it remains the preferred cutting tool in some niche applications like oxy-fuel welding and cutting. Oxyhydrogen was once used in working platinum because at that time such a torch was the only device that could attain the temperature required to melt the metal 1,768.3 degree centigrate. These techniques have been superseded by the electric arc furnace.
- A boost converter to drive low power devices like ZigBee.
- Power source for wireless sensor nodes network.
- An ultra low power management system for wireless sensor network.

VIII. CONCLUSIONS

As per the observation and results we can conclude that the generation of HHO depends upon two parameters namely Time and duty cycle of the PWM signal. Greater the time and duty cycle more the HHO will be generated keeping the non zero frequency constant.

IX. ACKNOWLEDGMENT

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