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Research Paper

A Study on Hy-Wire Technology: Opportunities and Challenges For Development

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ABSTRACT

Hy-wire technology is applied for design of vehicles using Hydrogen fuel cell for drive power and drive control by wire concept. Hy-wire system introduced in automotive sector will give an efficient electric drive vehicle. The conventional sources of energy cannot last forever, so alternative sources developed in Hy-wire technique improves energy source utilization apart from the traditional fuel system. Drive by wire technology gives complete digital control over the vehicle by computer connected to the body's electronic control through universal docking ports. Hy wire technology results in the improvements of physical size and smart control of vehicle with pollution free environment friendly byproduct.

INTRODUCTION

Limitation of petrol, diesel and other conventional energy source as fuel in automotive sector and it's hazards pollution has attracted attention all around the world and world-class locomotive manufacturers. Utilization of oil fuels are dangerous also because they pose a potential environmental concern.

The Hy-wire system is governed from the electrical power generated by a Hydrogen fuel cell using Proton Exchange Membrane (PEM) fuel cell. A fuel cell is an electrochemical energy conversion device that converts Hydrogen and Oxygen into water, producing electricity and heat in the process. This gives a new power system for locomotives with better efficiency and zero pollution to environment. Using drive by wire system compact automatic car system with modular design can be prepared. The name Hy-wire comes from the words hydrogen fuel drive system and drive by wire technology.The hydrogen fuel cell system replaces internal combustuion engine, mechanical linkages, transmission system, complicated mechanical and hydraulic parts and drive by wire technology gives the vehicle more flexibility and X-drive technique with electronic motor control for user friendly control over the vehicle. Using this, now concept cars are designed by General Motors.

HYDROGEN FUEL CELL

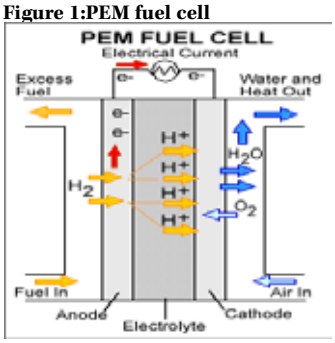
The fuel cells, which use hydrogen as a source of fuel, are called hydrogen fuel cells. The chemical reaction involved in hydrogen fuel cell are:

At Anode: $2H^2 = 4H^+ + 4e^-$

At Cathode: $O_2 + 4H^+ + 4e^- = 2H_2O$

In this fuel cell, chemicals constantly flow into the cell so it never goes dead. As long as there is a flow of chemicals into the cell, electricity flows out of the cell. The fuel cell itself is supplied with hydrogen from compressed hydrogen tanks located in the chassis. The fuel cell stack made up of 200 individual cells connected in series can produce d.c. voltage ranging from 125 V to 200 V, which is converted in a.c. voltage to run 3-phase electric motor. It can provide a continuous power of 94 kilowatts and peak power of 129 kilowatts.

Figure 1:PEM fuel cell

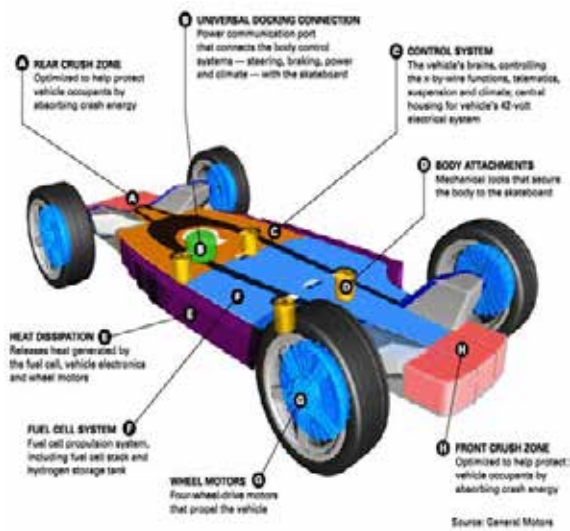


Sources:en.wikipedia.org

DESIGN FEATURES

The Hy-wire system using fuel cell stack completely removes the basic elements of car designs like internal combustion engine, mechanical and hydraulic linkages. The car's power system and electric motor are built into a flat skateboard configuration. This makes the whole vehicle lighter and more spacious, so highly flexible modular vehicle configuration becomes possible

Figure 2:chassis having Hy-wire setup



DRIVE BY WIRE

The Hy-wire car's drive-by wire technology has a central computer housed in the middle of chassis which works as brain of the system. The digital coupling of the cameras gives a better control to the drive system. Central computer system gives electronic signal for speed control of motor to control speed, steering and braking mechanism using sensors at different stages.

CHALLENGES

There is a great challenge to maintain the storage and supply of hydrogen in an active condition for hydrogen fuel cell. Four different methods for hydrogen storage currently being considered are (a) Liquid hydrogen (b) High pressure hydrogen (c) Solid state hydride storage and (d) Porous solid absorption of molecular hydrogen. But these storage methods require greater energy input for maintaining external physical conditions for storage system and also for its procurement preventing reactions.

CONCLUSIONS

Hy-wire technique in a fuel cell vehicle is advantageous in respect that, it has better fuel efficiency, more ecofriendly due to water as byproduct and highly spacious vehicle which are also driver friendly. But storage or generation and transportation of

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hydrogen for on board fuel cell stack is a challenge to meet safety and economy of the vehicle.

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