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21ST CENTURY INOVATIVE AUTOMOBILES

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Abstract—**The 21st century brought new concerns and pressures to the way companies innovate.If in the past innovation was predominantly driven by the intention of exceeding customers' expectation or to create simpler and less costly processes; today many organisations are required to respond to environmental and social demands. With regard to the environment, the major environmental concerns in the 21st century are: atmospheric pollution, scarcity of freshwater, raw material and land availability. All these environmental impacts have a great impact on how companies manage their business, and therefore, they are also a driver to innovation. Automobile is that sector due to which the pollution control rate is more than other any other sector. It is the need of the generation and for that many innovations have been done and many are going on. This paper talks about the technologies which will change the future of the automobile industry.**

Keywords— Tesla car, Self driving car, technology, Lotus.

I. INTRODUCTION

For 125 years the automotive industry has been a force for innovation and economic growth. Now, in the early decades of the 21st century, the pace of innovation is speeding up and the industry is on the brink of a new technological revolution: "self-driving" vehicles. The new technology could provide solutions to some of our most intractable social problems—the high cost of traffic crashes and transportation infrastructure, the millions of hours wasted in traffic jams, and the wasted urban space given over to parking lots, just to name a few. But if self-driving vehicles become a reality, the implications would also be profoundly disruptive for almost every stakeholder in the automotive ecosystem. As one industry executive put it, "Everything, from how we move goods to how we move ourselves around, is ripe for change."

For the past hundred years, innovation within the automotive sector has brought major technological advances, leading to safer, cleaner, and more affordable vehicles. But for the most part, since Henry Ford introduced the moving assembly line, the changes have been incremental, evolutionary. Now, in the early decades of the 21st century, the industry appears to be on the cusp of revolutionary change—with potential to dramatically reshape not just the competitive landscape but also the way we interact with vehicles and, indeed, the future design of our roads and cities. The revolution, when it comes, will be engendered by the advent of autonomous or "self-driving" vehicles. And the timing may be sooner than you think.

II. INOVATIONS IN 21ST CENTURY

A. Hybrid Cars

All hybrid cars available today have no provision to charge their batteries except by using energy that is ultimately generated by their gasoline engines. This means that they may be considered, from a pollution and energy efficiency perspective, to be nothing more than somewhat more efficient gasoline cars. If the EPA-certified gas mileage for such a car is 51 mpg, this is exactly the same as an ordinary gasoline car that gets 51 mpg. (If a hybrid car could recharge its batteries by plugging in when at home, and if its batteries held enough charge for a meaningful drive, this would not be true.) The most efficient hybrid car is the 2005 Honda Insight, which gets 63 mpg for combined city and highway driving. Using similar math as we used for the Civic VX above, the Insight's well-to-wheel energy efficiency is 0.64 km/MJ. The famous Toyota Prius is EPA-rated to get 55 mpg in combined city-highway driving, for an energy efficiency of 0.56 km/MJ.

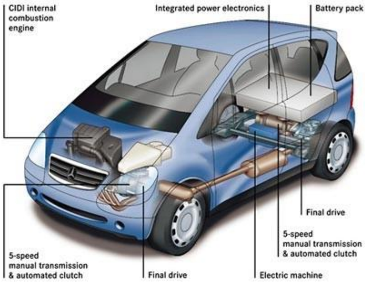


Fig. 1 Hybrid Vehicles

B. Electric Cars

Even with tires and gearing optimized for performance (rather that absolute efficiency), the Tesla Roadster only consumes about 110 watt-hours (0.40 mega-joules) of electricity from the battery to drive a kilometer, or 2.53 km/MJ. The energy cycle (charging and then discharging) of the lithium-ion batteries in the Tesla Roadster is about 86% efficient. This means that for every 100 mega-joules of electricity used to charge such a battery, only 86 mega-joules of electricity are available from the battery to power the car's motor. Thus, the "electrical-outlet-to-wheel" energy efficiency of the Tesla Roadster is 2.53 km/MJ x 86% = 2.18 km/MJ. The most efficient way to produce electricity is with a "combined cycle" natural gas-fired electric generator. (A combined cycle generator combusts the gas in a high-efficiency gas turbine, and uses the waste heat of this turbine to make steam, which turns a second turbine – both turbines turning electric generators.) The best of these generators today is the General Electric "H-System" generator, which is 60% efficient, which means that 40% of the energy content of the natural gas is wasted in generation. Natural gas recovery is 97.5% efficient, and processing is also 97.5% efficient. Electricity is then transported over the electric grid, which has an average efficiency of 92%, giving us a "well-to-electric-outlet" efficiency of 60% x 92% x 97.5% x 97.5% = 52.5%. Taking into account the well-to-electric-outlet efficiency of electricity production and the electrical-outlet-to-wheel efficiency of the Tesla Roadster, the well-to-wheel energy efficiency of the Tesla Roadster is 2.18 km/MJ x 52.5% = 1.14 km/MJ, or

Double the efficiency of the Toyota Prius.

Fig.2 Tesla Electric Car

C. *Hydrogen Fuel-Cell Cars*

Hydrogen does not exist in nature except as part of more complex compounds such as natural gas (CH4) or water (H2O). The most efficient way to produce large quantities of hydrogen today is by reforming natural gas. For new plants, the well-to-tank efficiency of hydrogen produced from natural gas, including generation, transportation, compression, is estimated to be between 52% and 61% efficient. The upper limit of efficiency for a PEM (Proton Exchange Membrane) fuel cell is 50%14. The output of the fuel cell is electricity for turning a drive motor, and we can assume the same 2.53 km/MJ vehicle efficiency as with the electric car. With these numbers, we can calculate the well-to-wheel energy efficiency for our hydrogen fuel-cell car: 2.53 km/MJ x 50% x 61% = 0.77 km/MJ. This is impressive when compared to a gasoline car, though it is 32% worse than our electric car. But real fuel-cell cars do not perform nearly this well. Several car companies have produced a small number of demonstration fuel-cell cars, and the EPA has rated the efficiency of some of these. The best fuel-cell demonstration car measured by the EPA is the Honda FCX, which gets about 49 miles per kilogram of hydrogen, 15 equal to 80.5 kilometres per kilogram.

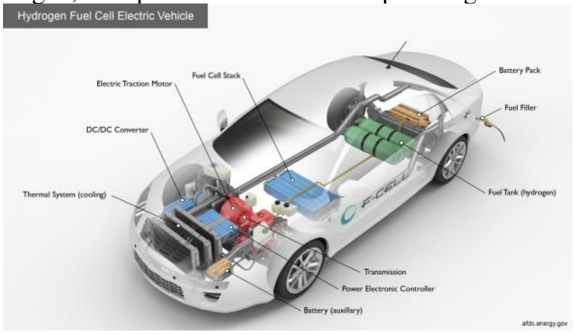


Fig.3 Hydrogen fuel Cell car

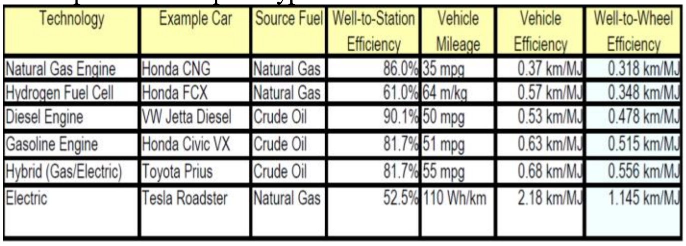
D. *Self Driving Cars*

Today, and possibly for a long time to come, the full driving task is too complex an activity to be fully formalized as a sensing-acting robotics system that can be explicitly solved through model-based and learning-based approaches in order to achieve full unconstrained vehicle autonomy. Localization, mapping, scene perception, vehicle control, trajectory optimization, and higher-level planning decisions associated with autonomous vehicle development remain full of open challenges. This is especially true for unconstrained, real-world operation where the margin of allowable error is extremely small and the number of edge-cases is extremely large. Until these problems are solved, human beings will remain an integral part of the driving task, monitoring the AI system as it performs anywhere from .The governing objectives of the MIT Autonomous Vehicle Technology (MIT-AVT) study are to (1) undertake large-scale real-world driving data collection that includes high-definition video to fuel the development of deep learning based internal and external perception systems, (2) gain a holistic understanding of how human beings interact with vehicle automation technology by integrating video data with vehicle state data, driver characteristics, mental models, and self-reported experiences with technology, and (3) identify how technology and other factors related to automation adoption and use can be improved in ways that save lives. In pursuing these objectives, we have instrumented 21 Tesla Model S and Model X vehicles, 2 Volvo S90 vehicles, and 2 Range Rover Evoque vehicles for both long-term (over a year per driver) and medium term (one month per driver) naturalistic driving data collection. Furthermore, we are continually developing new methods for analysis of the massive-scale dataset collected from the instrumented vehicle fleet. The recorded data streams include IMU, GPS, CAN messages, and high-definition video streams of the driver face, the driver cabin, the forward roadway, and the instrument cluster (on select vehicles). The study is ongoing and growing. To date, we have 78 participants, 7,146 days of participation, 275,589 miles, and 3.5 billion video frames. This paper presents the design of the study, the data collection hardware, the processing of the data, and the computer vision algorithms currently being used to extract actionable knowledge from the data.

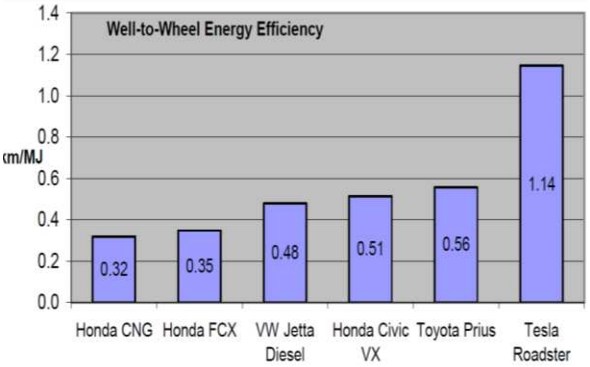
Fig.4 BMW i8 Self Driving Car

III. Comparison of 21st Century Cars

The following table shows the well-to-wheel energy efficiency of several types of high-efficiency cars – including an efficiency estimate of the Tesla Roadster – based on the measured performance prototypes.

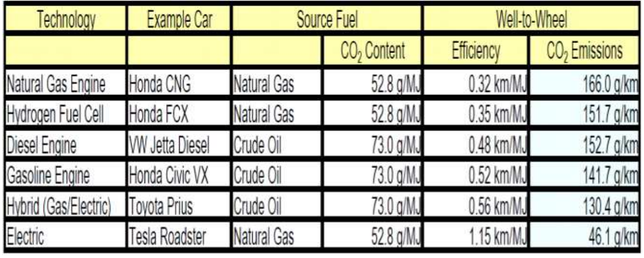


Technology	Example Car	Source Fuel	Well-to-Station Efficiency	Vehicle Mileage	Vehicle Efficiency	Well-to-Wheel Efficiency
Natural Gas Engine	Honda CNG	Natural Gas	86.0%	35 mpg	0.37 km/MJ	0.318 km/MJ
Hydrogen Fuel Cell	Honda FCX	Natural Gas	61.0%	64 m/kg	0.57 km/MJ	0.348 km/MJ
Diesel Engine	VW Jetta Diesel	Crude Oil	90.1%	50 mpg	0.53 km/MJ	0.478 km/MJ
Gasoline Engine	Honda Civic VX	Crude Oil	81.7%	51 mpg	0.63 km/MJ	0.515 km/MJ
Hybrid (Gas/Electric)	Toyota Prius	Crude Oil	81.7%	55 mpg	0.68 km/MJ	0.556 km/MJ
Electric	Tesla Roadster	Natural Gas	52.5%	110 Wh/km	2.18 km/MJ	1.145 km/MJ



IV. EMISSIONS

After the text edit has been completed, the paper is ready for the template. Burning fuel produces a variety of emissions, including sulphur, lead, unburned hydrocarbons, carbon dioxide, and water. Through the years, we have improved the emissions of both cars and power plants by reformulating the fuels to eliminate sulphur and metals, and by improving combustion and post-combustion scrubbing to eliminate unburned hydrocarbons. In the end, an ideal engine or power plant will only emit carbon dioxide and water. Water is fine, but carbon dioxide is the greenhouse gas that cannot be avoided. We can compute the well-to-wheel carbon dioxide emissions for a given vehicle in a way similar to how we computed energy efficiency, since we know the carbon content of the source fuel. With perfect combustion, all of the carbon in the source fuel will eventually become carbon dioxide. Assuming perfect combustion, we can calculate the "CO2 content" of any source fuel. Crude oil has a carbon content of 19.9 grams per mega-joule, and natural gas has a carbon content of 14.4 grams per megajoule. 1 gram of carbon becomes 3.67 grams of CO2, since the atomic weight of carbon is 12, and oxygen is 16. Therefore, the CO2 content of crude oil is 73.0 grams of CO2 per mega-joule, and natural gas has a CO2 content of 52.8 grams of CO2 per mega-joule. With these numbers, we can calculate the well-to-wheel emissions of the various vehicles, based on the carbon content of the source fuel and the energy efficiency of the vehicles:



Technology	Example Car	Source Fuel		Well-to-Wheel	
			CO_2 Content	Efficiency	CO_2 Emissions
Natural Gas Engine	Honda CNG	Natural Gas	52.8 g/MJ	0.32 km/MJ	166.0 g/km
Hydrogen Fuel Cell	Honda FCX	Natural Gas	52.8 g/MJ	0.35 km/MJ	151.7 g/km
Diesel Engine	VW Jetta Diesel	Crude Oil	73.0 g/MJ	0.48 km/MJ	152.7 g/km
Gasoline Engine	Honda Civic VX	Crude Oil	73.0 g/MJ	0.52 km/MJ	141.7 g/km
Hybrid (Gas/Electric)	Toyota Prius	Crude Oil	73.0 g/MJ	0.56 km/MJ	130.4 g/km
Electric	Tesla Roadster	Natural Gas	52.8 g/MJ	1.15 km/MJ	46.1 g/km

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[2] General Electric "H System" Combined cycle generator, model MS7001H/9001H, as installed in Cardiff, Wales, in Tokyo, Japan, and in Scriba, New York.

[3] Well-to-Tank Energy Use and Greenhouse Gas Emissions of Transportation Fuels – North American Analysis, June 2001, by General Motors Corp., Argonne National Laboratory, BP, ExxonMobil, and Shell. Vol. 3, Page 42

[4] Well-to-Tank Energy Use and Greenhouse Gas Emissions of Transportation Fuels – North American Analysis, June 2001,by General Motors Corporation, Argonne National Laboratory, BP, ExxonMobil, and Shell. Vol. 3, Page 59

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