RECENT TRENDS TOWARDS MANUFACTURING OF SMART AUTOMOBILE VEHICLES

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ABSTRACT:

Significant technological development has taken place, changing and reinventing how motor vehicles have been produced in the last 79 years. The manufacturing processes are now adopted to play greater role towards developments as aesthetical, aerodynamic, ergonomically comfortable design, with low periodic break down, highly fuel efficient and least pollution emitting motor vehicles. The complete process lines are almost undergoing automation to ensure quality, durability and cost effectiveness, resulting better future by way of sustainability of energy as well as adding to Fuel Saving & release of low emission to reduce Health hazards & Ecological imbalances. Since the fast depletion of fossil fuel has now a day become worldwide problem and technology has generally led to a greater use of hydrocarbon fuels for about 150 years, thus the decrease in supply of fossil fuel is making civilization vulnerable. The use of large number of vehicles for transport is also contributing to about 70% of total air pollution. In India vehicular pollution has also reached 8 times than it was 20 years before. Currently India is the fifth country which produces higher rate of emission and creating environmental & ecological imbalance after rating of USA, China, Russia & Japan. The world wide researches are going on and Japan has taken leading role for development of automobile vehicles at large. This paper covers the history of technological developments, use of CAD / CAM in designs, use of modern techniques for manufacturing processes & unconventional machining processes for vibration free, low noise and most balanced engines, use of sensor devices, development of alternative fuel efficient & low pollution automobile engines, tapping all other non conventional energy sources to develop fuel cell, battery operated, photocell and compressed air motor vehicles for future.

Keywords: fossil-fuel, pollution, fuel-efficient, motor vehicles

1.0 INTRODUCTION

From the record, it is found that the first beginning of mobile vehicle was started in 1335, when several Italians designed wind driven vehicles. It was a wind mill type drive to gears and thus to wheels. Later Leonardo Da Vinel designed a clock work driven tricycle with tiller steering and a differential mechanism between the rear wheels. The Curved Dash Oldsmobile had single cylinder engine tiller steering & chain drive were sold in 1901-600 for $650 and the next year were in 1902-2500, 1903-4000 , 1904-5000. The 200 automobile vehicles were produced in mass by Ford Company in 1903.

The period marked end of the beginning of the automobile. The Rolls Royce Silver Ghost of 1906 was a six cylinder car that stayed in production until 1925, thereafter luxury Cars, Transport vehicles (e.g. Trucks, Buses, Passenger & Goods Trains with Steam Engine, Diesel Engine & Electric Motor driven vehicle took its larger pace to benefit the mankind and hence enriched the civilization. The entire researches were concentrated to hydro carbon (e.g. fossil fuel) about 100 years before, when

Internal Combustion Engine took its developments.

An American oil geologist **Marion King Hubbert**, in 1956 predicted that US oil production would peak in 1970 and decline thereafter. The "Hubbert Curve" [10.1] illustrated practical availability of a region's oil reserves over time describes a bell-shaped curve. After exploration and initial growth in output, production plateaus and eventually declines to zero and there could be crises of fossil fuel after 40 years. The lots of reserves were explored. A recent study made in 2004[10.2] predicted that if the hydrocarbon fuel /oil is consumed at the current rates, the consumption may reach to 80% of the entire available resource by 2020.On other hand larger use of fossil fuel have been contributing to high emission rate and raised the pollution level [10.6] subsequently creating Human Health hazards & other subsequent problem of global heating penetration in ionosphere.

India's vehicular pollution is estimated to have increased eight times over the last two decades. This source alone is estimated to contribute about 70 per cent to the total air pollution. With 243.3 million tons of carbon released from the consumption and combustion of fossil fuels in 1999, India ranked fifth in the world behind the U.S., China, Russia and Japan. India's contribution to world carbon emissions is expected to increase in the coming years due to the rapid pace of urbanisation, shift from non-commercial to commercial fuels, increased vehicular usage and continued use of older and more inefficient coal-fired power-plants.

This necessitates the search for alternative of oil as energy source or preserving it by tapping some other alternatives such as Non-conventional energy like battery operated vehicles, wind mills, photocells etc. and to convert their output into mechanical energy, which may alternatively preserve oil source besides the development of most efficient and low pollution automobile vehicles. To day there is need of **development of Smart Automobile Vehicles** to make human life free from accident, to provide best comfort, low fuel consumption and emission free – zero pollution environments**.**

2.0 HISTORY OF DEVELOPMENT OF MOBILE VEHICLES:

2.1 What Was The First Car? (10.3)

Several Italians recorded designs for wind driven vehicles. The first was Guido da Vigilant in 1335. It was a windmill type drive to gears and thus to wheels. Vaturio designed a similar vehicle which was also never built. Later Leonardo da Vinci designed clockwork driven tricycle with tiller steering and a differential mechanism between the rear wheels.

In about 1678, a Catholic priest named Father Ferdinand Verbiest has been said to have built a steam powered vehicle for the Chinese Emporer Chien Lung. There is no information about the vehicle, only the event.

Until 1712,since Thomas Newcomen didn't build his **first steam engine** we can guess that this was possibly a model vehicle powered by a mechanism like Hero's steam engine, a spinning wheel with jets on the periphery. Newcomen's engine had a cylinder and a piston and was the first of this kind, and it used

steam as a condensing agent to form a vacuum and with an overhead walking beam, pull on a rod to lift water. It was an enormous thing and was strictly stationary.

In 1765 James Watt developed the first pressurized steam engine which proved to be much more efficient and compact that the Newcomen engine.

In 1769, **the first vehicle to move under its own power** for which there is a record was designed by Nicholas Joseph Cugnot and constructed by M. Brezin. A replica of this vehicle is on display at the *Conservatoire des Arts et Metiers*, in Paris. I believe that the Smithsonian Museum in Washington D. C. also has a large (half size?) scale model. A second unit was built in 1770 which weighed 8000 pounds and had a top speed on 2 miles per hour and on the cobble stone streets of Paris this was probably as fast as anyone wanted to go it. The picture shows the first model on its first drive

Museum.

Henry Ford had an engine running by 1893 but it was 1896 before he built his first car. By the end of the year Ford had sold his first car, which he called a Quadra cycle, for $200 and used the money to build another one. With the financial backing of the Mayor of Detroit, William C. Maybury and other wealthy Detroiters, Ford formed the Detroit Automobile Company in 1899. A few prototypes were built but no production cars were ever made by this company. It was dissolved in January 1901. Ford would not offer a car for sale until 1903.

2.2 Production of Automobile Car: [10.3]

The first closed circuit automobile race held at Narragansett Park, Rhode Island, in September 1896. All four cars to the left are Duryeas, on the right is a Morris & Salom Electrobat. Thirteen Duryeas of the same design were produced in 1896, making it the **first production car**.

At left is pictured the factory with produced the 13 Duryeas. In 1898 the brothers went their seperate ways and the Duryea Motor Wagon Company was closed. Charles, who was born in 1861 and was eight years older than Frank had taken advantage of Frank in publicity and patents. Frank went out on his own and eventually joined with Stevens Arms and Tool Company to form the Stevens-

Duryea Company which was sold to Westinghouse in 1915. Charles tried to produce some of his own hare-brained ideas with various companies until 1916. Thereafter he limited himself to writing technical book and articles. He died in 1938. Frank got a half a million dollars for the Westinghouse deal and lived in comfort until his death in 1967, just seven months from his 98th birthday.

In this engraving Ransom Eli Olds is at the tiller of his first petrol powered car. Riding beside him is Frank G. Clark, who built the body and in the back are their wives. This car was running by 1896 but production of the Olds Motor Vehicle Company of Detroit did not begin until 1899. After an early failure with luxury vehicles they established the first really successful production with the classic Curved Dash Oldsmobile.

The Curved Dash Oldsmobile had a

single cylinder engine, tiller steering and chain drive. It sold for $650. In 1901 600 were sold and the next years were 1902 - 2,500, 1903 - 4,000, 1904 - 5,000. In August 1904 Ransom Olds left the company to form Reo (for Ransom Eli Olds). **Ransom E. Olds was the first mass producer of gasoline powered automobiles in the United States**, even though Duryea was the first auto manufacturer with their 13 cars.

The Rolls Royce Silver Ghost of 1906 was a six cylinder car that stayed in

production until 1925. It represented the best engineering and technology available at the

time and these cars still run smoothly and silently today. **This period marked the end of the beginning of the automobile.**

After a century of the automobile, we can begin to assess the effects of long term transport by internal combustion. Nearly every aspect of our lives has developed around this technology.

3.0 WHAT IS SMART AUTOMOBILE VEHICLES?

Only now, are we seeing new digital communications technologies, of the internet and beyond, that may eventually displace some of the functions of the automobile and replace our current problems with a new set that you, our grandchildren, will be charged with solving? Ask your grandparents about their first car. I'm sure you will get to hear a great story. But we want look for new dimension of automobile cars which may be free from all the current problems, those are being faced & beyond the manual control / mistakes which occurs and causes risk to human life.

The car which satisfies following parameters may be placed under definition of ***smart auto-mobile vehicles:-***

- Aerodynamic body & least weight
- Minimum road gap (i.e. distance between Centre of gravity and road)
- Larger wheel space
- Balanced, high speed & vibration free engine
- Noise free power gears & differential gears
- Moderate & strong chassis
- Comfortable interior & requisite facilities
- Fuel efficient & low emission
- Accident free on roads

Thus the definition of **Smart Automobile Vehicles / Cars** sounds more than what we ultimately desire for better riding, pollution free environment for the society and to contribute to modern civilization. The answer lies with microprocessor / sensor based control over speedy run, braking system, over-turning, global positioning systems, tracking for sides, front & back running / standing vehicles or objects. This needs attention on use of high strength alloy material, use of CAD / CAM & CATIA[10.4] for designing, use of modern techniques for manufacturing processes & unconventional machining processes for vibration free, low noise and most balanced engines, development of fuel efficient & low pollution automobile engines, alternatively tapping all other non conventional energy sources to develop fuel cell, battery operated, photocell and compressed air motor vehicles to overcome the future problem of depletion of fossil fuel. *Electrically operated motors or Compressed Air / Gasoline operated turbines are the solution for vibration free, comfort riding and longer lasting vehicles.*

4.0 MODERN TREND IN DESIGNING PROCESSES:

Today's world moving forward to design most sophisticated components of vehicles in very short time. The use of Computer Aided Design, Computer Aided Manufacturing and CATIA [10.4] to prepare drawing as well as working models to evaluate its functional working is found effective solution. The use of

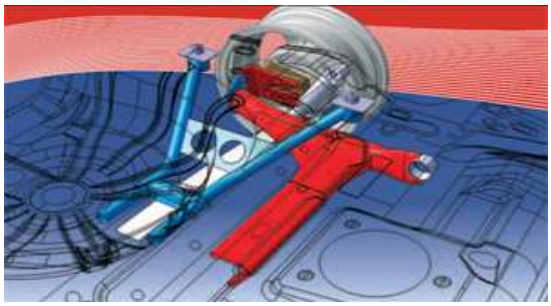
CATIA is very rapidly taking its pace world wide for aerodynamic body as well as parts where indigenous shape are required to be given.

4.1 CAD, CAM &CATIA V5 for Automotive Design:

CATIA is the world's leading CAD/CAM/CAE software. This software gives you a broad range of integrated solutions that cover all aspects of:

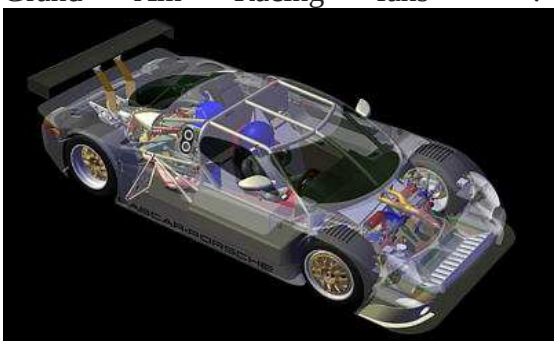
- Product design & manufacture.
- Driving enterprise competitiveness
- Task productivity Process improvement

CATIA (Computer-Assisted Three-Dimensional Interactive Application) is acclaimed throughout the world as the leading program for use in design. CATIA offers unequalled scope of functionality, together with total integration of all its functions, thereby ensuring that its users are able to address the most challenging design tasks, and then translate those into realistic, manufacturable products. It also opens up new frontiers in Concurrent Engineering, leading to better designs, at lower cost, in significantly shorter time. With a development history stretching over more than 15 years, CATIA has proven itself in every imaginable industry, and with the availability of Release 5, which operates on a PC platform, is accessible by even the smallest of manufacturers. Use of CATIA V5 is being done very rapidly by MIRA, a leading independent design, development, testing and research organization which provides a service to the worldwide automotive industry[10.4].



4.2 CAD, CAM CAE –Daytona Prototype Racing Car

The Daytona Prototype is a new class of Grand Am racing car scheduled to debut in the 2003.It has flawless performance of race car designed in Solid Edge wows Grand Am Racing fans [10.5].



5.0 MODERN TREND IN MANUFACTURING PROCESSES:

Keeping in view of world wide problem of fast depletion of fossil fuel and use of higher rate of vehicular transport causing high pollution, necessitate modern trend in manufacturing process for automobile engine, which may run with very high efficiency and consume very less fuel. It

should also emit least pollution & satisfy pollution limit as per the act [10.6].

While the automobile is a commonly used product, it is an extremely complex and technologically sophisticated one. Manufacturing new cars requires state-of-the-art technological methods and processes. In addition, supplier industries of the automotive manufacturing industry, such as steel and other parts as well as electronic instrumentation, are vital in providing the necessary supplies and components for assembling motor vehicles.

To improve product quality and efficiency in production, automakers invest a large amount of time and money into developing and improving the manufacturing process, and rely heavily on research and technological innovation. Modern technologies used in advancing manufacturing for the automotive industry include:

- **Programmable machines and tools**-Robotics
- **High speed data communication and data management**-NC & CNC machines
- **Supercomputing**-Product & Process developments
- **Virtual manufacturing and complex visualization techniques**-Modeling & evaluating by CAD, CAM, CATIA & Pro- Engineers
- **Advanced techniques** – Unconventional machining, forming & forging.

Over the last 25 years, automation technology has become an essential part of automobile assembly plants. A typical assembly plant uses several hundred robots to build and paint the vehicle frame. While robotic technology continues to grow in assembly plants, the technology does have limitations, especially in performing more delicate tasks. The advent of Intelligent Assist Devices, in particular Cobots (Collaborative robots), aided in reducing ergonomic concerns, while also improving safety, quality and productivity. Cobots, developed by Northwestern University and General Motors Corporation, are designed to work in collaboration with human operators to move objects and perform physically demanding tasks on vehicle assembly lines [10.7].

6.0 ELEMENTS OF AUTOMOBILE MANUFACTURING

Cost	Technology and Process
Durability	Workforce and Organization
Product Development	Logistics and Supply Chain
Process Development	Research and Engineering
Flexibility	Interfaces
Facilities	Equipment

In looking at trends in global automobile manufacturing**, Japanese automakers** have been leaders in stream-lined manufacturing process systems. These methods have been adopted by manufacturing plants worldwide.

7.0 AUTOMOBILE TECHNOLOGY & INNOVATION

Due to competitive market pressure, the product life-cycle for automobiles continues to be shortened. It forces

automakers to dramatically redesign car models every four to five years.

New technological developments have led to unique and innovative designs for future automobiles. Automobile manufacturers use the development of new technologies to enhance performance capability, as well as to create innovative designs. Alternative fuel technologies, such as electric hybrids and fuel cell cars, have received considerable attention, and demonstrate attempts to design vehicles that are more energy efficient and greatly reduce engine propulsion reliance upon fossil fuels and more to looked for energy conversion like compressed air or zero pollution vehicles

7.1 Electric Powered Vehicles

The movement towards electric powered vehicles began as a result of the 1973 Oil Embargo, in which efforts were made to utilize electric battery technology to power engine propulsion. However, problems and limitations regarding driving range, speed and a very small market, all led to automakers GM, Ford, Honda and Toyota discontinuing their electric vehicle programs during the late 1990's.

7.2 Hybrid Powered Vehicles

Hybrid vehicles combine two or more sources of power, which are able to operate using a rechargeable battery and gasoline. Production of gas-electric hybrids signifies the first significant move away from total reliance on the internal-combustion engine in nearly a century.

Hybrid vehicles are highly fuel efficient and present the first major step toward fuel cell vehicles, according to industry specialists. Japanese automaker Toyota is one of the auto industries leaders in hybrid vehicle research and production with its Prius model. General Motors, also involved in producing hybrid vehicles, will be introducing and mass producing its hybrid model by 2007. [10.8]. Most major automakers plan to introduce hybrid vehicles to the market within the next five years.

7.3 Fuel Cell Vehicles

Another automobile technology that is presently viewed as the latest catalyst in future automobile technology, is fuel cell powered vehicles, in particular hydrogen fuel cell powered engines. Fuel cell systems operate by compressing hydrogen made from natural gas and gasoline, which is then converted to hydrogen by on-board systems. [10.9]

Automakers and suppliers worldwide are investing substantially in the development of fuel cell systems. General Motors (GM), Ford and DaimlerChrysler have invested billions of dollars in a collaborative project to develop hydrogen fuel cell technology. GM is perhaps the most active in investing, as well as researching and developing fuel cell technology. However, many industry specialists indicate that fuel cell technology will not be available on the commercial market until the next 10 to 15 years.

There are, however, problems associated with hydrogen fuel systems which consist of:

- Fuel cell vehicles will be more expensive

- Fuel cell cars will require a new infrastructure for vehicle manufacturing and maintenance
- Developing a system for producing and distributing hydrogen fuel

Many uncertainties remain regarding the development and use of hydrogen fuel cell technology, as well as addressing the major question on how to create a viable infrastructure that supports the use of fuel cell vehicles.

7.4 Compressed Air Light Vehicles

Korean inventor "Beau de Rocha" (Otto) developed zero pollution cars using Quasiturbine with a set of 14- engines parameters and disclosed on Sept'2005 using gasoline. [10.10]

"Guy Negre", a French Scientist , in 1998 developed compressed air- 4-cylinders engine run on air and gasoline, claims zero pollution cars and got 52-patents registered since 1998 to 2004.The car was demonstrated in Oct.'2004 publically.[10.11]

"E.J. Honton" an USA based inventor in April'2004 presented the Hydrogen Fuel Cell Car at 15th Annual US Conference & Hydrogen Expo, USA and projected the scope of its market in different country. [10.12]

8.0 ADVANCED PRODUCT DESIGN AND OPERATING SYSTEMS FOR SMART VEHICLE:

Modern automobiles are increasingly relying upon more advanced electronics, computer, and wireless communication systems to assist drivers and enhance safety. These technologies replace mechanical systems that power, steer and brake the vehicle. Most vehicles have several computers, with high-end models having a half dozen or more that control functions, which range from shifting gears to operating GPS navigational systems. [10.13]

GM has introduced the Autonomy concept model, which uses hydrogen fuel cell technology that powers electric motors in each wheel. The vehicle uses a chassis and replaceable body, allowing greater flexibility and freedom in designing the interior. Internally, the vehicle operates without pedals or dashboard, using sophisticated computer and electronic systems to operate the vehicle.

Voice activation is another technology being developed for use in future vehicles. Voice activation systems are expected to operate internal climate controls, open doors, and respond to navigational request by the driver.

The next step in automobile electronic and communications technology is vehicle sensor technology. Sensor technologies use radar or laser technology to control systems that detect vehicles in front which then automatically slow down the vehicle. Companies are using sensor technology to serve as collision-avoidance systems that operate and control vehicle safety systems and on-board equipment.

9.0 CONCLUSION:

In view of growing requirement of energy, fast depletion of fossil fuel and change in living style , it has become inventible to look into alternative energy source, develop energy efficient &

accident free automobile vehicle using all advanced techniques of design, developments, manufacturing, testing for zero defect and adopting sensering devices so called SMART AUTOMOBILE VEHICLES. Following conclusions are drawn from current study:-

- Fuel efficient vehicles can add sustainability to fuel energy resource.
- Fuel efficient vehicles can release low emission & reduce pollution hazard.
- Use of electric motor, hybrid power vehicles, hydrogen cell vehicle and compressed air vehicles will overcome the sustainability problem of fossil fuel. Air has enormous potential and can be the best alternative to fossil fuel driven vehicles.
- Trend to adopt advanced technique for design by CAD, CATIA will improve the look, comfort & durability of future Automobile Vehicles apart from its running.
- Trend to adopt advanced manufacturing processes / development / robotics will cut down cost as well as improve the efficiency of Auto Mobile Vehicles.
- Trend to adopt electronic & communication sensor will detect vehicles in front / sides and back, which then automatically slow down the vehicle. Using sensor technology to serve as collision-avoidance systems that operate and control vehicle safety systems and on-board equipment.
- Voice activation is another technology being developed for use in future vehicles for opening-closing doors and other devices.

Thus the dream of Smart Automobile Vehicle will definitely change the future and will be the best alternative to the need of day.

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