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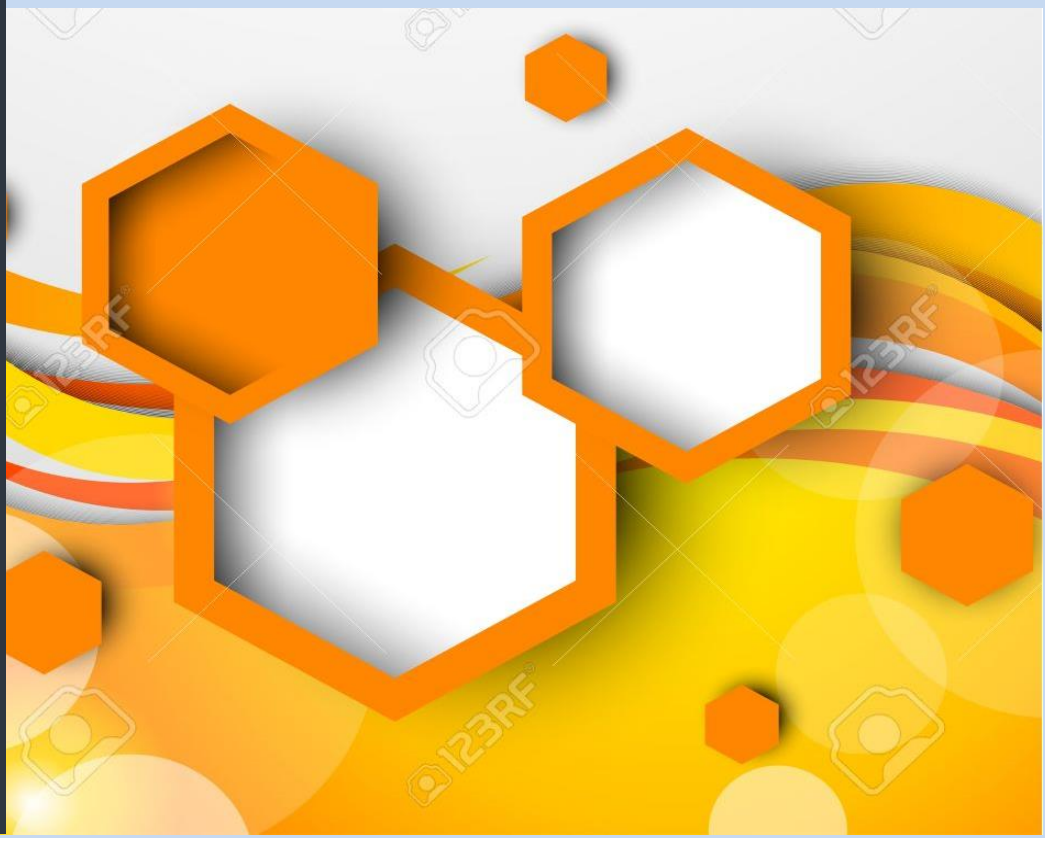
PRAGYAN

Half Yearly Students' Technical Times

RANE POLYTECHNIC
LEARN AND GROW

RANE POYTECHNIC TECHNICAL CAMPUS



Application of Smart Skins in Aerospace Industry

V.Sriram
III Year, DME

Introduction

Smart systems consist of sensors and actuators that are either embedded in or attached to the system containing central control and command unit to form an integral part of it. Smart or intelligent materials are materials that have the intrinsic and extrinsic capabilities, first to respond to stimuli and environmental changes and second to activate their functions according to these changes.

Smart Material IN Aerospace in Industry

There two types of materials used

1. Piezoelectric material
2. Magnetostrictive Material
3. Shape memory alloys
4. Electro-Rheological fluid

1. Piezoelectric Material

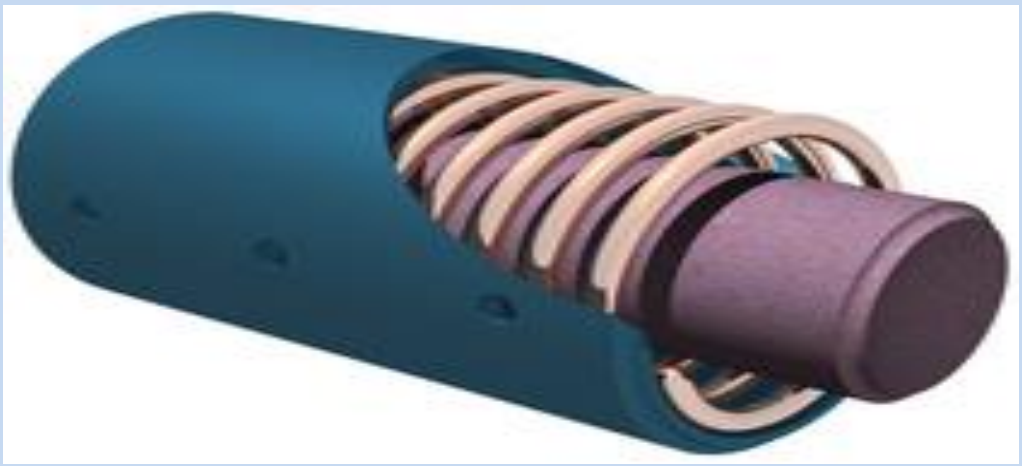
The pressure, acceleration, temperature, strain (or) force converting them to an electric charge. Piezoelectric materials have the special property of producing an electrical voltage in response to an applied force. Usually crystals or ceramics, piezoelectric materials have a variety of uses including sonar, sound detection and high-voltage generation in addition to everyday uses, such as cigarette lighter ignition sources and barbecue-grill igniters.

APPICATIONs;

- Auto mobile industry
- Nuclear instrument
- Aerospace instrument

2. Magnetostrictive Material

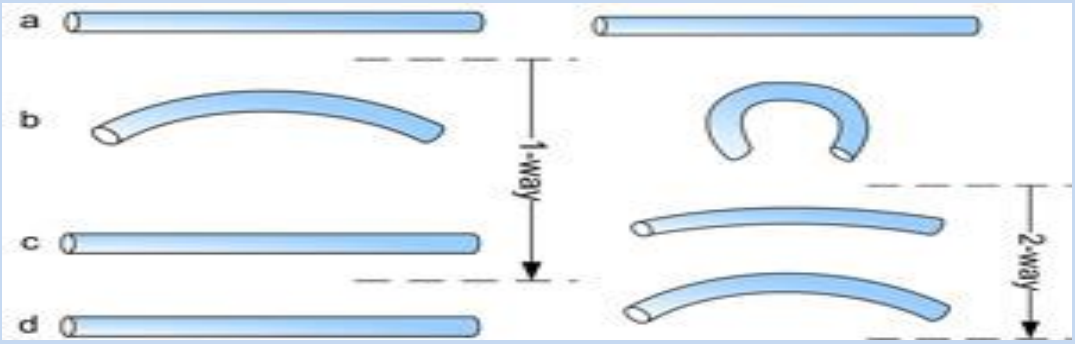
Ferromagnetic material that causes them to change their space (or) dimension of magnetization. Magnetostrictive materials include nickel and alloys such as Fe-Al (Alfer), Fe-Ni (Permalloy), Co-Ni, Fe-Co, and Co-Fe-V (Permendur); several ferrites ($CoFe_2O_4$ and $NiFe_2O_4$); and some rare earths and their alloys and compounds. Nickel has good magnetostrictive, mechanical, and anticorrosion properties. Permendur has large values of saturation magnetostriction Δ_s and magnetization. The ferrites have high specific electric resistivity and corrosion resistance; they are also the least expensive magnetostrictive materials.



3. Shape Memory Alloys

A shape memory alloy its original shape and that when deformed returns to its pre-deformed shape when heated. This material is a lightweight. Nickel titanium, also known as Nitinol (part of shape memory alloy), is a metal alloy of nickel and titanium, where the two elements are present in roughly equal atomic percentages e.g. Nitinol 55, Nitinol 60. A shape-memory alloy is an alloy that can be deformed when cold but returns to its pre-deformed ("remembered") shape when heated. It may also be called memory metal, memory alloy, smart metal, smart alloy, or muscle wire. Parts made of shape-memory alloys can be

lightweight, solid-state alternatives to conventional actuators such as hydraulic, pneumatic, and motor-based systems. They can also be used to make hermetic joints in metal tubing.

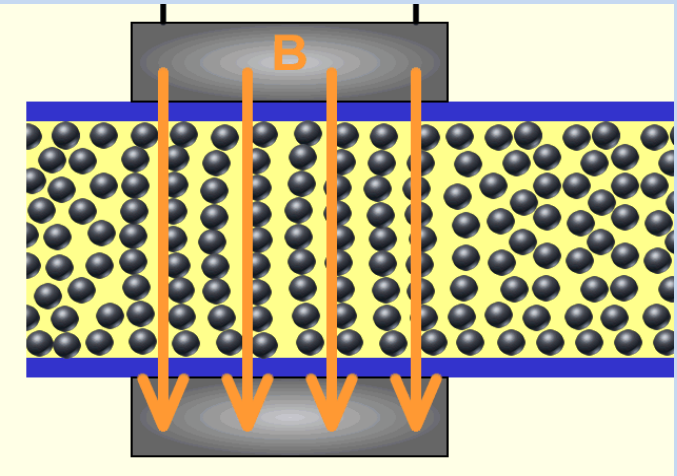


Applications:

- Aircraft and spacecraft
- Robotics
- Orthopedic surgery
- Telecommunication
- Dentistry
- Optometry

4.Electro-Rheological fluid

Magnetic field the fluid greatly increase its apparent viscosity the point of becoming a viscoelastic solid. A class of liquid which stiffens into a semi-solid when subjected to a electric field. Electro rheological fluids are most commonly colloidal suspensions, and their stiffening under an electric field is reversible. Under the electric field, electro rheological fluids form fibrous structures which are parallel to the applied field and can increase in viscosity by a factor of up to 10^5. The stiffening of an electro rheological fluid is sometimes called the Winslow effect after its first investigator, Willis Winslow in 1949. Electrorheological fluids can be characterized by their Mason number. The effect has been proposed as a method of constructing shock absorbers on magnetically levitated trains. Lithium polymethacrylate is an example of an electro rheological fluid.



APPICATIONS:

- Mechanical engineering
- Military and defense
- Aerospace
- Automotive

Classification of Smart Materials

They possess the capacity to modify their geometric or material properties under the application of electric, thermal or magnetic fields, thereby acquiring an inherent capacity to transduce energy. Smart materials are common name for a wide group of different substances. The general feature of all of them is the fact that one or more properties might be significantly altered under controlled condition. The present age is considered to be the smart materials era. Earlier, smart material was defined as the material, which responds to its environments in a timely manner. However, the definition of smart materials has been expanded to the materials that receive, transmit, or process a stimulus and respond by producing a useful effect that may include a signal that the materials are acting upon it. This study focuses on the introduction of smart materials and their classifications. Different applications of smart materials in various fields are also being discussed starting from engineering to the present environment.

Smart materials, called also intelligent or responsive materials,[1] [2] are designed materials that have one or more properties that can be significantly changed in a controlled fashion by external stimuli, such as stress, temperature, moisture, pH, electric or magnetic fields, light, or chemical compounds. Smart materials are the basis of many applications, including sensors and actuators, or artificial muscles, particularly as electro active polymers (EAPs) Terms used to describe smart materials include shape memory material (SMM) and shape memory technology (SMT).[9]

Types

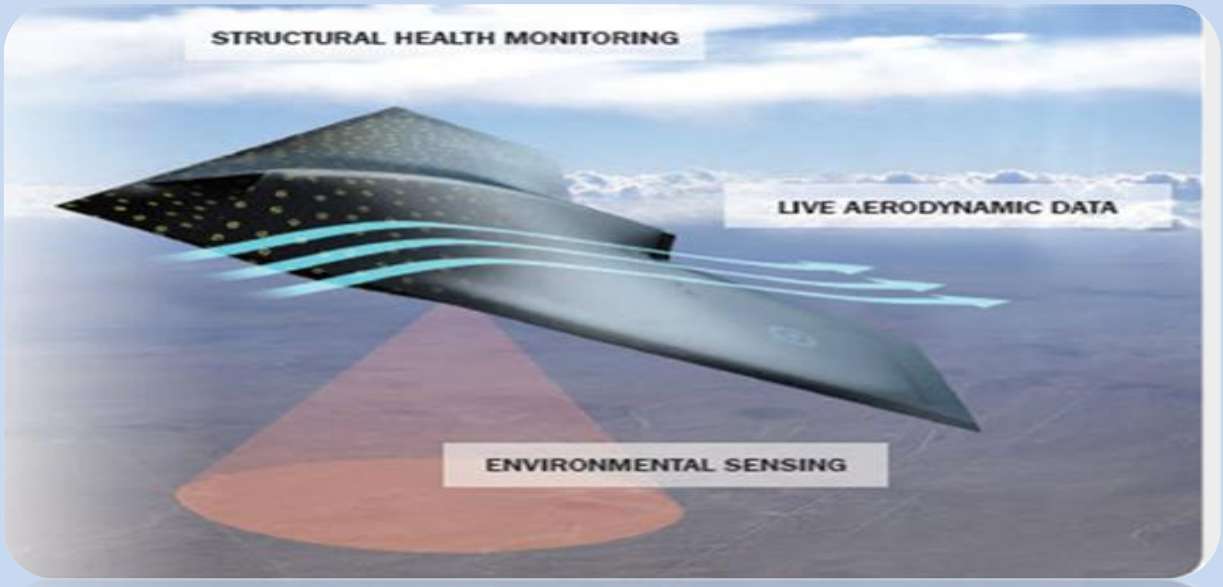
There are a number of types of smart material, of which are already common. Some examples are as following:

- Piezoelectric materials are materials that produce a voltage when stress is applied. Since this effect also applies in a reverse manner, a voltage across the sample will produce stress within sample. Suitably designed structures made from these materials can, therefore, be made that bend, expand or contract when a voltage is applied.
- Shape-memory alloys and shape-memory polymers are materials in which large deformation can be induced and recovered through temperature changes or stress changes (pseudoelasticity). The shape memory effect results due to respectively martensitic phase change and induced elasticity at higher temperatures.
- Photovoltaic materials or optoelectronics convert light to electrical current.
- Electroactive polymers (EAPs) change their volume by voltage or electric fields.
- Magnetostrictive materials exhibit a change in shape under the influence of magnetic field and also exhibit a change in their magnetization under the influence of mechanical stress.
- Magnetic shape memory alloys are materials that change their shape in response to a significant change in the magnetic field.
- Smart inorganic polymers showing tunable and responsive properties.
- pH-sensitive polymers are materials that change in volume when the pH of the surrounding medium changes.
- Temperature-responsive polymers are materials which undergo changes upon temperature.
- Halochromic materials are commonly used materials that change their color as a result of changing acidity. One suggested application is for paints that can change color to indicate corrosion in the metal underneath them.
- Chromogenic systems change color in response to electrical, optical or thermal changes. These include electrochromic materials, which change their colour or opacity on the application of a voltage (e.g., liquid crystal displays), thermochromic materials change in colour depending on their temperature, and photochromic materials, which change colour in response to light—for example, light-sensitive sunglasses that darken when exposed to bright sunlight.
- Ferrofluids are magnetic fluids (affected by magnets and magnetic fields).
- Photomechanical materials change shape under exposure to light.
- Polycaprolactone (polymorph) can be molded by immersion in hot water.
- Self-healing materials have the intrinsic ability to repair damage due to normal usage, thus expanding the material's lifetime.
- Dielectric elastomers (DEs) are smart material systems which produce large strains (up to 500%) under the influence of an external electric field.

- Magnetocaloric materials are compounds that undergo a reversible change in temperature upon exposure to a changing magnetic field.
- Thermoelectric materials are used to build devices that convert temperature differences into electricity and vice versa.
- Chemoresponsive materials change size or volume under the influence of external chemical or biological compound.[10]

Smart Slins

Smart skin is a large-area, flexible array of sensors with data processing capabilities, which can be used to cover the entire surface of a machine or even a part of a human body. Depending on the skin electronics, it endows its carrier with an ability to sense its surroundings via the skin's proximity, touch, pressure, temperature, chemical /biological, or other sensors. Aerospace products such as rockets, satellites and aircrafts are typically monologue shell-like structures featuring a thin skin whose structural integrity is generally mission-critical.



Smart Skins in Aerospace Industry

Smart Skin Technologies is a technology development company based in Fredericton, New Brunswick, Canada. Smart Skin has developed and commercialized a pressure-sensitive skin technology that is aimed at a variety of applications.

The behavior of smart skins has triggered the evolution of an embryonic technology which typically would feature actuators, sensors, data-links and microprocessors. This class of sophisticated structures has been termed ‘smart skins’ .

Components of Smart Structures:

The basic five components of a smar**t** structure are

1. Data Acquisition (tactile sensing): the aim of this component is to collect the required raw data needed for an appropriate sensing and monitoring of the structure.

2.Data Transmission (sensory nerves): the purpose of this part is to forward the raw data to the local and/or central command and control units.

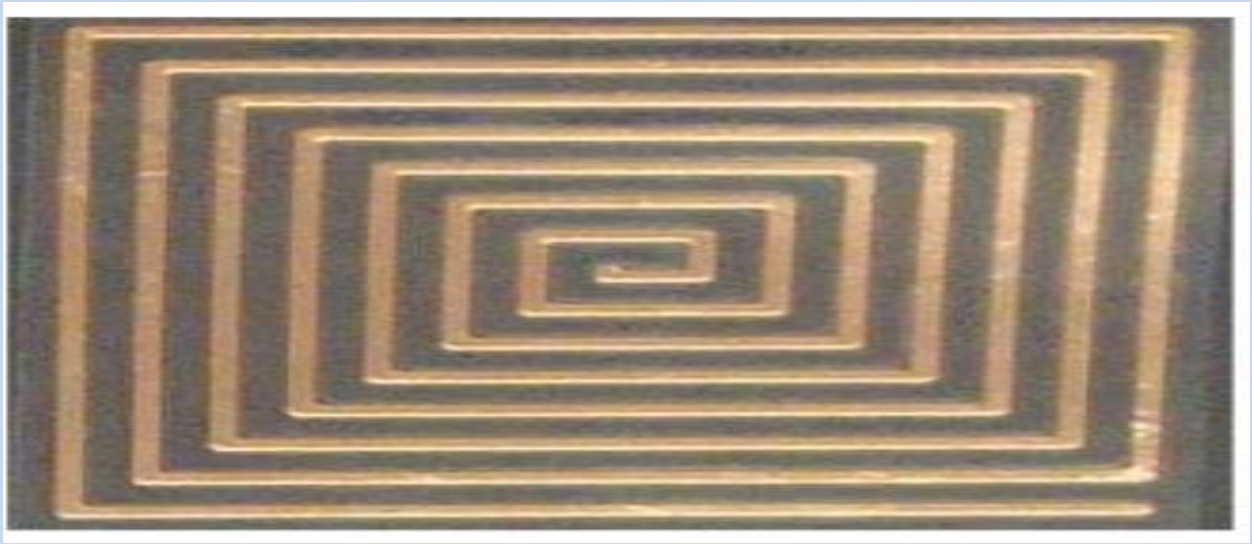
3.Command and Control Unit (brain): the role of this unit is to manage and control the whole system by analysing the data, reaching the appropriate conclusion, and determining the actions required.

4.Data Instructions (motor nerves): the function of this part is to transmit the decisions and the associated instructions back to the members of the structure.

5.Action Devices (muscles): the purpose of this part is to take action by triggering the controlling devices/ units.

SansEC:

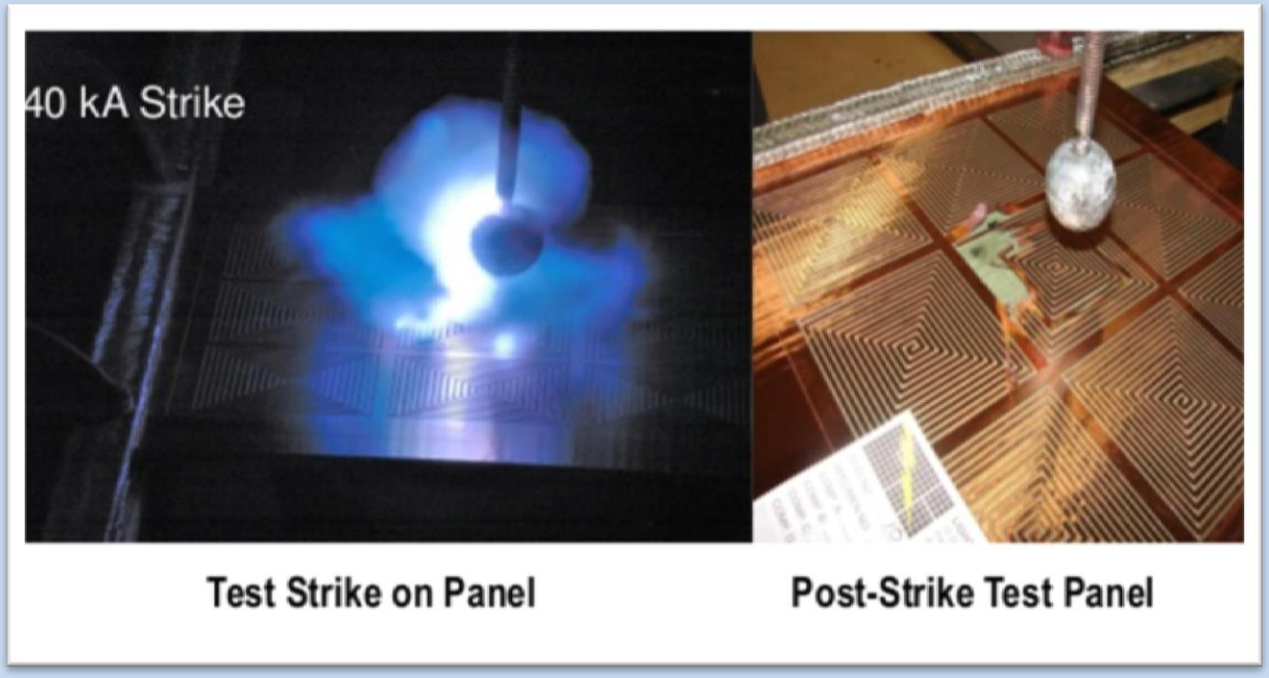
SansEC sensor technology is a new technical framework for designing, powering, and interrogating sensors to detect various types of damages in composite materials. The source cause of the in-service damage(lightning strike, impact damage, material fatigue, etc., to an aircraft composite is secondary. The sensor will detect damage independent of the cause.



Smart Skin concept in Aeroplane

The concept is to apply an array an array of sansEC Sensors to an aircraft surface forming a smart skin Layer on the composite. Lighting protection, enhanced shielding effective, damage detection and diagnosis function s

A sansEC "Smart Skin " for Lightening Strike Protection

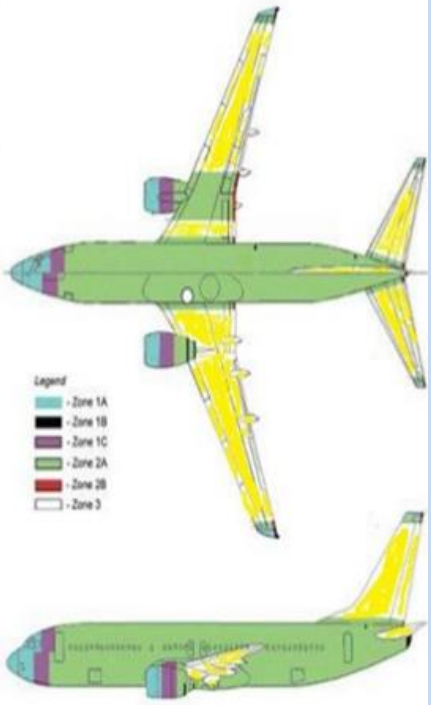


Functions	SansEC Sensor Array	Metal Mesh
Lightning Protection	Yes	Yes
Damage Detection *In-situ	Yes	No
Shielding Effectiveness	Yes	Yes
Damage Diagnosis	Yes	No
Potential Functions		
Measuring Aerodynamic Loads	Yes	No
Fuel Quantity Indication	Yes	No
Icing Detection	Yes	No

Smart skin for Lightning Strike Protection

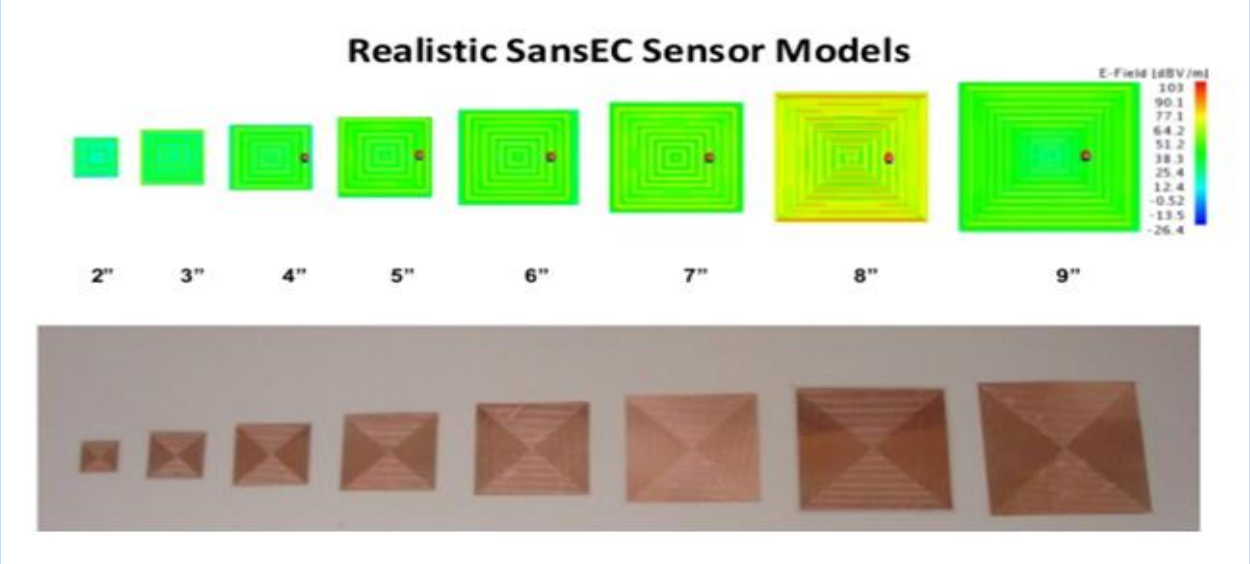
A SansEC "Smart Skin" for lightning Strike Prectection:

Aircraft Zone	Voltage Waveforms(s)	Current Component(s)
1A	A, B, D	A, B, C*, H(200KA)
1B	A, B, D	A, B, C, D, H
1C	A	Ah, B, C*, D, H
2A	A	D, B, C*, H (100KA)
2B	A	D, B, C, H
3 (Conducted)	-	A, B, C, D, H
3 (Direct attachment)	A	A/5, B, C* (40KA)
Model Tests	C	



ARP5412- APPLICATION OF LIGHTNING ENVIRONMENT TO AIRCRAFT ZONES

A SansEC "Smart Skin " for Damage Detection:



Smart Skin for Damage Detection:

ARP5412B – Aircraft Lightning Environment and Related Test Waveforms:

The environment and test waveforms defined by the SAE Aerospace Recommended Practice ARP5412 – Aircraft Lightning Environment and Related Test Waveforms accounts for the best lightning data and analysis currently available. The waveforms provided in the ARP5412 are considered to be adequate for the demonstration of compliance for the protection of an aircraft and its systems against the lightning environment and should be applied in accordance with the aircraft lightning strike zones (see ARP5414) and test methods (see ARP5416), and applicable FAA and EASA advisory and interpretive material.

Morphing Aircraft Structures:

The ultimate structure for a smart structure is the morphing structure that can reconfigure shape, stiffness or control to achieve a new performance objective. A Morphing Air Structure is a seamless, aerodynamically efficient, aerial vehicle capable of radial shape change and able to generate superior performance over static design. It is an individual aircraft that can service multiple mission roles with variable geometric wings, fuselage or even propulsion system. Airplanes fly under a wide range of temperature, density and wind conditions. They also have to perform different flight manoeuvres during a flight. The aircrafts are designed to have the best performance in the most important flight stage, which depend on the mission that the aircraft have to accomplish. When they fly out of the optimal flight condition, the performance is severely affected. Although fixed wings must operate under the design condition, this is not possible often, especially in aircrafts which have a wide operating range, like surveillance and military aircrafts. For commercial aircrafts during takeoff, landing and other short flight stages, high-lift devices are used to improve the performance. Nowadays, researches are being conducted to create airplanes' structures that may radically change their shape in-flight, in order to get the best aircraft shape for the given flight condition. The aircrafts will be able to operate in optimal conditions throughout the entire flight envelope, which will increase their fuel efficiency and maneuverings capabilities. These aircrafts are called "morphing aircrafts". So far, new concepts never have gone further than the experimental state due to the high complexity of structures, the lack of energy efficiency as well as the weight efficiency of the actuation devices. Recently, new technologies and the creation of advanced materials made possible the design of morphing wings that can adapt to a specific flight condition in order to improve the aircraft performance.

Conclusion

This presentation has reviewed applications of 'smart skins' technology to aerospace industry. The application includes lightning strike protection, damage detection, smart wings, aircraft health monitoring, morphing aircraft structures etc.. The applications of smart structures showed the capability to address difficult dynamic structural problems with novel techniques with positive results.

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Solar Spraying Machine

R.Johanan Samuel
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R.Mahesvarma
DME – A, II Year

Abstract

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. The government of India appointed a commission to assess the feasibility of increasing the crop productivity under prevailing Indian ecological conditions. In order to develop the standard of living of small farmers we should make the machines with low cost. Then only small farmers can implement the recent modern machines for farming purposes. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and spacing, cover the seeds with soil and provide proper compaction over the seed. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement vary from crop to crop and for different agricultural and climatic conditions to achieve optimum yields and an efficient sowing machine should attempt to fulfill these requirements. In addition, saving in cost of operation time, labor and energy are other advantages to be derived from use of improved machinery for such operations. A traditional method of seed sowing has many disadvantages. Our proposed "Solar seed sprayer machine"

Introduction

Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. In this paper, "Design and fabrication of solar seed sprayer machine". In this technique seeds in a hopper get sprayed by means of fan or blower directly to land without human effort. By this process the seed is feed to land at the time of plough

Solar Seed Sprayer Machine

The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and spacing, cover the seeds with soil and provide proper compaction over the seed. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement vary from crop to crop and for different agricultural and climatic conditions to achieve optimum yields and an efficient sowing machine should attempt to fulfill these requirements.

To develop for living of small farmers:

- ✓ Low cost.
- ✓ Small farmers can implement the recent modern machine
- ✓ To overcome the drawback of traditional method of seed sowing

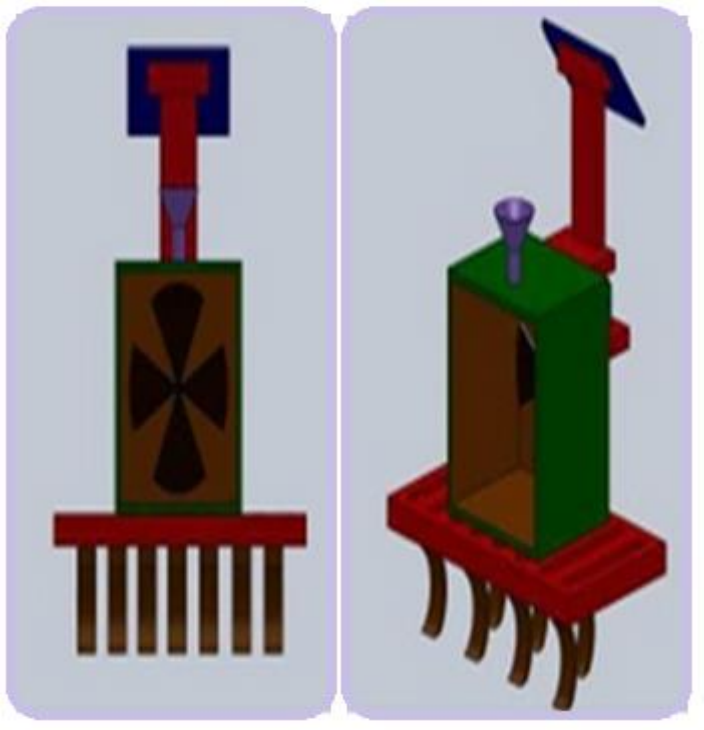
Major Components Solar Seed Sprayer Machine

- ✓ Hopper
- ✓ Solar panel
- ✓ Battery
- ✓ Fan
- ✓ Connecting wires

Material Selection:

The selection of material is based on cost, availability and suitability of materials for heat treatment. Hopper is made up of G.I sheet of 20G material

Seed sowing setup on the tractor digger



The main benefit of using this method

- ✓ Reduce the time of seed to the land and
- ✓ Reduced human effort.
- ✓ Solar panel is employed as a power source.
- ✓ Does not require any additional power source.

Merits

- ✓ Simple operation.
- ✓ Maintenance cost is low.
- ✓ No seed loss in terms of remaining in the hopper.
- ✓ Low cost.
- ✓ It is more suitable for small farmers.
- ✓ Reduced size and complexity when compared to existing machine.
- ✓ No Power needed.
- ✓ Human power is not necessary

Conclusion

A solar seed sprayer machine is designed for small farmers to improve their productivity. In this machine a common seed storage place is introduced to reduce the cost of the machine. The drawbacks in the existing sowing machine are rectified successfully in our machine. It will be more useful for small farmers and the agricultural society. Thus solar operated automatic seed sowing machine will help the farmers of those remote areas of country where fuel is not available easily.Here using solar energy environment pollution can also be reduced.

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Role of Mechanical Engineer in Agricultural Field

E.Sabarish, DME – II Year **S.Tharmadurai, DME – II Year**

Introduction

Mechanical engineers are involved with the generation, distribution, and use of energy. This could be as a part the control and automation of manufacturing systems, the design and development of machines or the solutions to environmental problems.

Reason of Engineers to Enter in Agriculture

The engineer is the part of the industry to service the society.An engineer also can develop the agriculture.To design a technology to develop the agriculture field is created by an engineer.Engineers apply technological advances to farming. For example, they design farming equipment that uses GPS systems (Global Positioning Systems). They help agricultural and food scientists create biological applications for developing crops with new, sturdier traits

Top most Agriculture Countries

- China.
- India.
- USA.
- Russia.

China

- China is the worlds largest populous country and world largest food work force.
- With some estimates they use 315 million people as workers.

India

- India is the second largest food work force.
- So Indian government can reduce the rate of the agricultural products to move India in first position.

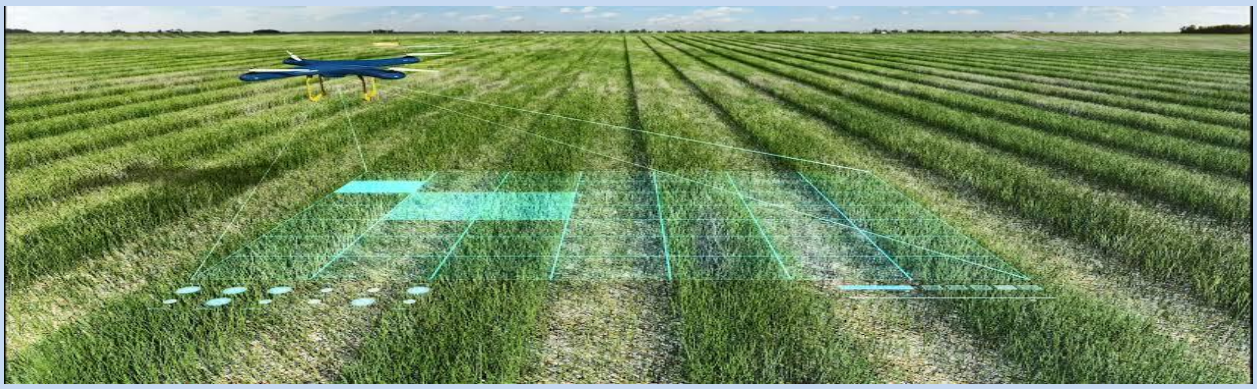
New Technologies in Agriculture

Technology has played a big role in developing the agricultural industry.Today it is possible to grow crops in a desert by use of agricultural biotechnology.With this technology, plants have been engineered to survive in drought conditions.

Through genetic engineering scientists have managed to introduce traits into existing genes with a goal of making crops resistant to droughts and pests.I mentioned the use of mobile apps by a farmer to calculate the amount of grass available in field.The technologies has turned farming into a real business, now farmers have electrified every process, a consumer can place an order directly online and the product will be transported from the farm to consumer in time when it's still fresh.

Future of Agriculture

Smart farming is a farming management concept using modern technology to increase the quantity and quality of agricultural products.Farmers in the 21st century have access to GPS, soil scanning, data management and internet of things technologies.



By precisely measuring variations within a field and adapting the strategy accordingly, farmers can greatly increase the effectiveness of pesticides fertilizers and use them more selectively. Similarly using smart farming techniques, farmers can better monitor the needs of individual animals and adjust their nutrition correspondingly, thereby preventing disease and enhancing herd health.

Importance of Agriculture Field

The 70% of our population is directly engaged in Agriculture. In others countries very small being 5% in UK, 4% in USA, 16% in Australia, 14% in in France, 21% in Japan, 32% in USSR. In our country only many people are engaged with agriculture, but people not taking it seriously, they are going into their own and other jobs. This should be change hereafter, everyone should work in field to develop the agriculture.

Conclusion

The role of mechanical engineer iincreasing agricultural productivity. Through the analysis of agricultural mechanization to modern agriculture, promoting the development of precision agriculture. At last, some advices on speeding up agricultural.

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VEHICLE 2020

R.SAMPATH KUMAR
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Abstract

The emissions from the internal combustion engine are a major threat to the environment and thus needs to be controlled and kept a close watch onIndia has decided to jump directly to BS VI after BS IV leapfrogging BS V. This paper mentions a few methods by which the target can be achieved and newer and better methods to achieve BS VI target.

Introduction

BS is basically the emission standards given by Government of India to regulate the air pollutants coming from internal combustion engine. BS stands for Bharat Stage and are set by the central pollution control board. BS standard is generally applicable to all the vehicles that are running in the country

BS IV Definition

A BSIV (Bharat Stage IV) is an evolution to specially bikes and 2 - wheelers engine (exhaust system)to produce lower emissions. Now it will produce much lower amount of CO, NOx ,CO2 & SO2 than earlier used BSIII engines, which is responsible for global warming and air pollution. They generally treats the harmful gases in CATALYSTIC CONVERTORS to convert them into less harmful gases and then releases it to atmosphere.

Difference of Bs 4 & Bs 6

- The major difference between the BS IV and BS VI is the vehicular emissions.
- BS VI vehicles will be more effective for the diesel engines, which releases a huge amount of sulphur in the emission.
- Presently the BS IV engines release around 50PPM(Parts per million) of sulphur and shifting to BS VI will drastically reduce it’s quantity to 10PPM.
- So BS VI engines are more cleaner and cause less environmental pollution(one of the biggest problem of the future generation).

Difference of both engines

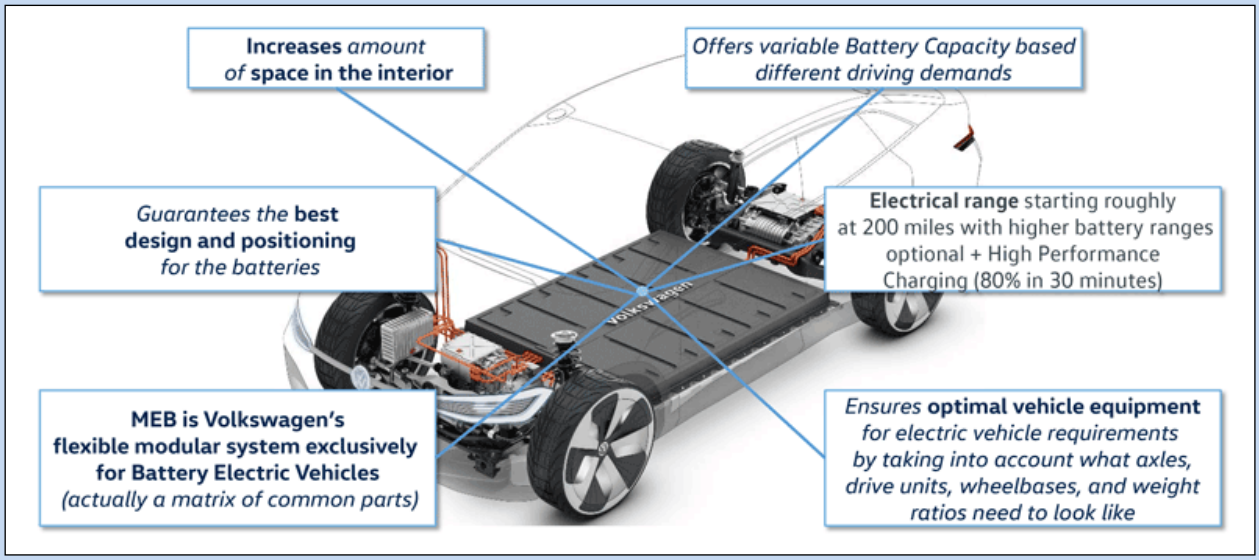
- ✓ The changes are going to be related with the calibration of emissions with the addition of exhaust after treatment systems like SCR, DPF, DOC, LNT for diesel engines and catalytic converter for petrol engines.
- ✓ There is no much of change in engine parameters of bs IV and bs VI Engines.
- ✓ Main changes are in the after treatment(exhaut after treatment) of the engine.
- ✓ DOC (Diesel oxidation Catalyst).
- ✓ DPF (Diesel Particulate Filter).
- ✓ SCR (Selective Catalytic Reducer).
- ✓ ASC (Ammonia Slip Catalyst).
- ✓ The engine also consist of air control system such as turbo speed controller intake air throttle control valve or exhaust throttle control valve.

Advantages of BS VI over BS IV

- ✓ BS VI is in lines with Euro VI norm already adopted in European countries.
- ✓ In fact, this new emission norm will also address one major drawback in the Euro VI norm that allows emission of higher PM (particulate matter) in diesel engines.

SIGINIFICIANT ADVANTAGES OF BHARAT STAGE VI STANDARDS

- ❖ Nox emission will reduce by 25% for the petroleum motor and 68% for the diesel motors.
- ❖ The PM emission will see a generous lessening of 80% in diesel motors.
- ❖ RDE (Real Driving Emission) will be presented out of the blue that will gauge the out flow in genuine conditions and not simply under test conditions.
- ❖ The purpose for making OBD required is to ensure that the discharge control segment work at its ideal proficiency constantly.



Electric Bike

- The electric motor and batteries for the revolt RV400, India's first smart electric bike, will be imported while the battery management system and ECU have been developed in house by revolt intellicrop.
- Revolt's electric bike has an ARAI claimed a range of 156km while the top speed is pegged at 85 kmph.

Conclusion

The electric vehicles in India sets in from 2030, Suzuki and Toyota collaborated electric vehicles could be seen on Indian roads. Suzuki is expected to also utilise its lithium ion battery plant in India which Suzuki is setting up along with Toshiba and Denso. In short, it could be a great Japanese presence in India. t's final now as both Toyota and Suzuki have confirmed the introduction of electric vehicles in India by 2020. Japanese car majors Toyota Motor Corporation (Toyota) and Suzuki Motor Corporation (Suzuki) have concluded a memorandum of understanding (MOU) on moving forward in considering a cooperative structure for introducing electric vehicles (EVs) in the Indian market in around 2020.

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Rapid Tooling in 3D Printing

N Vignesh
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Abstract

3D printing (3DP) is one of the innovative developments in rapid prototyping (RP) technology. The goal of the initial inception and progress of the technology was to assist the product development phase of product design and manufacturing. The technology has played an important role in educating product design and 3D modeling because it helps students/designer to visualize their design idea, to enhance their creative design process and enables them to touch and feel the result of their innovative work. To find how much time did the product taken to create with 3d printing and foundry and how much accuracy did they get on each method.

***Rapid* Tooling (RT)**

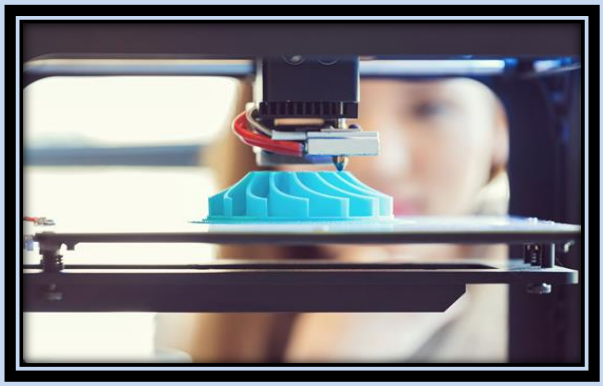
Rapid Tooling is the result of the unison of Rapid Prototyping techniques with conventional tooling practices in order to produce a mold quickly. This process, as well, is used to prepare parts of a functional model from CAD data in less time and at a lower cost RT denotes manufacturing on a slim timeline. Some of the main advantages to rapid tooling trades is that it decreases the time and cost of the product. However, the disadvantages are that it is not as accurate and also shortens the lifespan of the product. Rapid tooling is mainly used for specific needs including prototyping and troubleshooting existing problems.

Introduction:

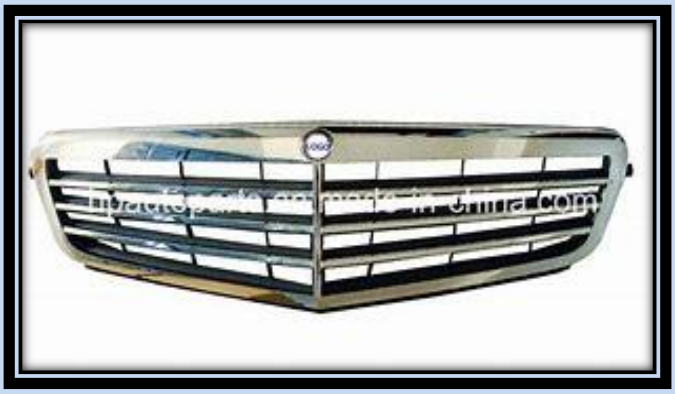
3D printing can be a great technology for those who are looking to figure out how to effectively reduce costs and save time. In the case of sand casting for the right application, 3D printing can be an invaluable option for producing quality parts at a much smaller price.3D printed moulds are ideal for the production of small

product runs where the cost of traditional tooling would be prohibitive. By printing your mould, it is a great replacement for wax pattern making saving weeks off the traditional process for prototyping metal.

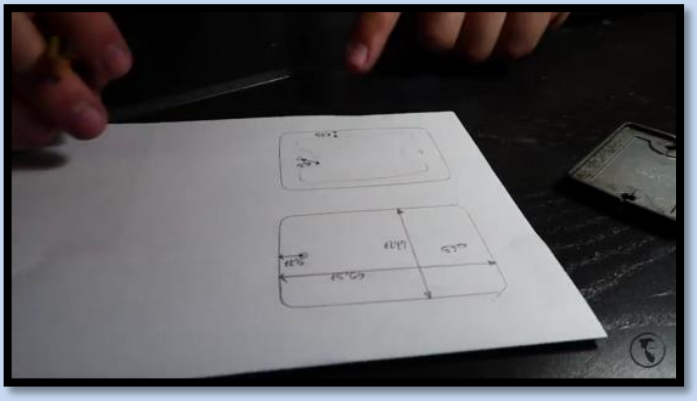
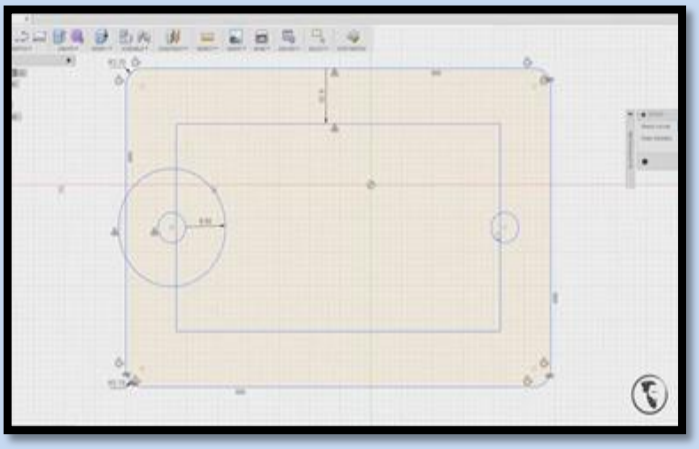
Essential part of Foundries (PATTERN METHOD)

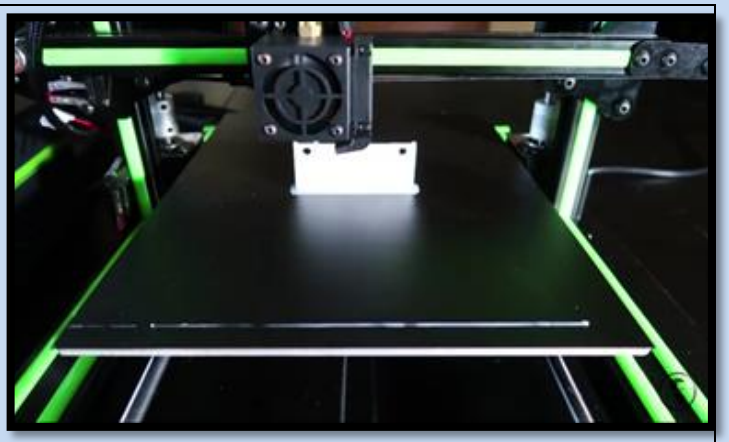
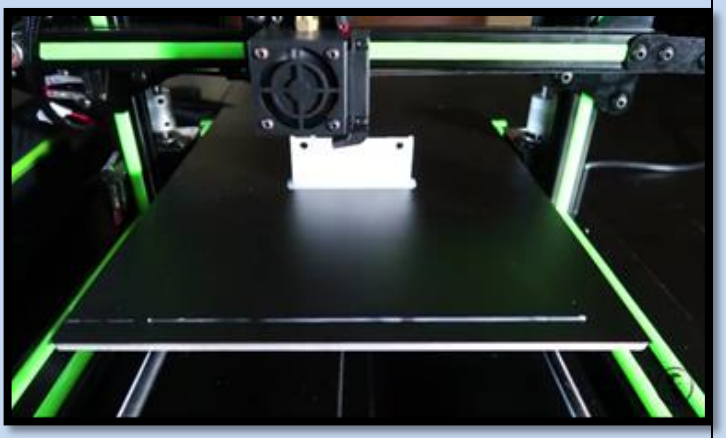
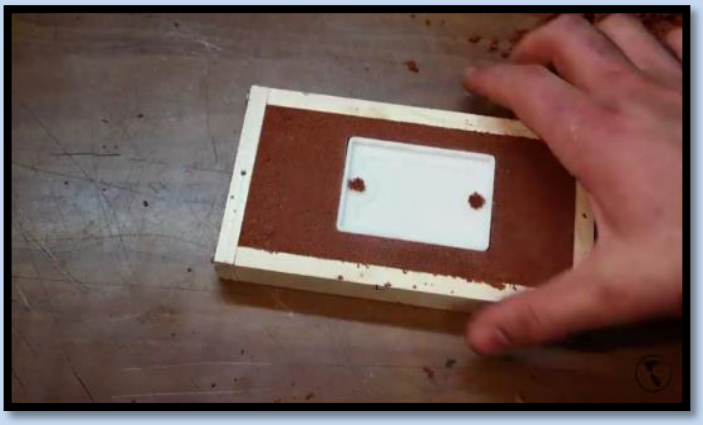
Description	Images
1. Pattern is normally made in CNC	
2. Now days 3d printing Model.	

Companies uses 3D printing to make pattern

Description	***Images***
1.DANK ARLINGTON (USA): Ship parts manufacturing	
2.PROSILAS(ITALY):Auto mobile parts manufacturing	
3.GULFOAST ROBOTIES (USA) : CNC, Robotics parts, Rocket parts	

Process Track of 3D printing to Foundry casting

Thinking: *What pattern we are going to make in 3D printing.*	
Creating model: *To apply the model what we think in your cad to make 3D.*	
Dimensions: *All dimensions cannot be applied on 3D. So, the scale needs to be reducing for more accuracy in pattern.*	

3D printer: *To choose 3D printer correctly. Because all 3D printers can't be good for all dimensions*	
Material choice: *There are lots of materials in 3D printing. Choose best material for your in pattern.*	
Sand for cavity: *To choose correct sand that does not damage the pattern and fall apart. Then it filter the sand from rocks and spray it in box*	
Print orientation: *For easy removal from the sand mould, ideally your pattern should be printed with the layer lines perpendicular to the parting line.*	

Pattern removal: *The pattern can be removed by two methods. one is by melting pattern and another is removing pattern.*	
Casting: *Pouring: The molten metal in cavity using runner & verify the filling using riser*	
Cleaning the Material: *The material is cleaned by water to remove sand in its gaps and unwanted parts are removed.*	
Polishing & Use: *After cleaning material is polished. Then it can be used where we want to.*	

The material needed size is created using Foundry and 3D printing, Just in 60 minutes	

Applications

- *3d printing is mainly used in foundry for making pattern*

  to produce mould.

- *Integrate 3D Tech with Art Foundry process:*

  The traditional process of clay modelling – bronze casting is been taken place by 3D scanning/ printing- bronze casting process.

- *It is not only faster but also more economical.*

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Smart Car Technologies & Hybrid Car

Introduction

A Kiruthika, DME – III Year

The technology inside the car is moving at considerable pace from simple Driving Assistance Systems (DAS) to Advanced Driver Assistance Systems (ADAS) and from the simple mechanical cockpit to an interactive connected cockpit. A Few years ago, choosing a new car was relatively straightforward. After cost, and possibly colour for some, primary concerns were things like engine size, performance and fuel efficiency. Over time, cars have matured to be more comprehensive and software oriented as more cars are connected to the internet either through direct in-vehicle dashboard controls or through the existing data coupled via the driver's personal devices. Today, car manufacturers are making our selections more difficult by adding all means of the advanced tech features. Innovations and changes have become an inevitable part of the automotive industry. The revolution has set the stage to the extent that the manufacturers are not thinking about "Why do we need a Smart Car?" but to "How could we deliver a Smart Car?" Most Original Equipment Manufacturers (OEMs) are now involved in one form or another with the smart car concept. OEMs need perceptibility on how to make the infotainment system easier to use, empower a platform for the future services, line up with industry regulations and make the smart car experience impeccable to the consumer.

Automakers are developing a variety of new technologies that will make cars far more digitally functional and smart than they are now, including high-resolution touch screen display, 4G LTE internet access, Wi-Fi, built-in satellite navigation systems, voice recognition systems, safety systems like driver assistance devices, etc. While these systems can indisputably improve the driving experience, there are fears they may also be too distracting for drivers, and making roads more dangerous as a result.

In the competition for providing more and more features with connected user experience, the main focus of developing the user interaction inside the car could worsen. No matter how appealing it might be to include more and more functionalities in the car to enrich the driving experience and its fun factor, the primary task of "driving" should never be placed out of the focus or should never make a trade-off to a highly interactive, technologically advanced cockpit. Most additional tasks on top of the primary task create cognitive load; some tasks are "cognitive overload" by requiring too much consideration from the driver, and others are "cognitive under load" by taking over parts of the driving tasks [NHTSA 2006]. Both types of tasks are highly likely to decrease the driver's attention to the environment and focus on the driving. Being engaged in additional tasks which are not related to driving is the main reason for the car accidents.

As a part of an ECOCAR 3 project, I worked in the innovation team. The project was sponsored by the U.S department of energy (DOE) and General Motors and the aim was to redesign the in-car interaction of the 2020 Chevrolet Camaro and also keep driver distraction to a minimum. The ECOCAR 3 project is a four-year competition in which 16 different teams from across the United States are participating to build the hybrid electric version of the muscle car, Chevrolet Camaro. Arizona State University (ASU) is being one 3 of the 16 participating teams; this work was done as a part of an innovation team at ASU. The extension of the work is carried out by another team member.

Scope:

The motive of this study is to analyze and explore the smart cars, to point out the influence of the technology on the smart car interaction design, and to identify the technology trends to improve the interaction and minimize driver distraction. This also sheds light on the advanced driver assistance technologies that have influenced the in-car environment as well as prospects to support the human-centered design (HCD) process of novel automotive user interaction. There are ways to minimize driver distractions but this thesis focuses on the two. One is to improve the existing in-car interaction design. Another way is to provide advanced driver assistance in terms of making the driving task easier, more automated and safer. The first one serves the basis for the discussion on the interaction designs inside the car today. The interaction design is really crowded and feature-oriented rather than user-centered. The second one puts the question at what extent the driver should get assistance so that he is not (under loaded) completely careless and machine dependent. So to support the discussion, the types of the user interaction and their practicality for use while driving were analyzed in more details. The discussion in the work centres around the limited areas of the in-car environment which are the areas affecting the driver distraction. The areas of the in-car controls can be defined as instrument cluster, steering wheel, infotainment display, climate and media controls, car system controls, rear and front mirror controls, front passenger side auxiliary display controls, and real display controls.

Smart Car Technology:

The past few years have been an essential period, both in terms of the pace of innovation and improved consumer awareness of the connected car technology. From in dash infotainment to heads up display (HUD), from touch interfaces to voice interaction, technology continued to transform the automotive industry on the several fronts this year.

Advance Driver Assistance Systems (Adas)

It covers the analysis of the ADAS in smart cars and Autonomous driving cars. This assistive technology helps the driver to make driving easier and safer. The challenge is to make the driver aware of the assistive technology and its features in the car and also provide an easy way to interact with them without getting distracted. This chapter provides the classification of ADAS, related technology, and introduces the autonomous driving.

In context to the Multi-Modal interaction, it is required that we virtualize all of the available Manual button related to ADAS as well. The broad classification of ADAS systems presented by DERSEV is given this section. It is classified in 10 groups with each group having several applications that are currently available or will be soon introduced in the automotive market. Thus, while designing the enhanced MMIS, it is desirable that the most of the manual buttons for this application can be virtualized as well as the easy to identify interaction is provided to get the best out of these assistive technology.

Lane Departure Warning System (LDWS):

At the end of a long drive back from our holiday or after a nerve-wracking, exhausting day at work, sleep creeps up on us almost unobserved and we are notoriously at risk of falling asleep for a few seconds. Drowsiness is a factor in roughly one in four severe accidents, mainly at night when the possibility of an accident is twice as great as by day. This is just one of the worst circumstances when 122 the system can help, but there are many more scenario which can bring a car close to a accidental leaving of the lane – at the end this could be as risky as falling asleep. LDWS signals the driver with acoustical or haptic warnings before his vehicle is about to leave the lane. According to a study carried out on behalf of the Federal Ministry of Education and Research, LDWS could prevent just about half of the accidents caused in this way.

LWDS uses sensors behind the front bumper to monitor the lane markings, three on each side. When the sensors notice that the car is wandering across the lane markings and the indicators are not in use, typically a computer sends a signal to a pair of vibration devices, on each side of the driver's seat. If the car is wandering to the right, the driver senses a vibrating signal in the right side of the seat and vice versa. Thus, the warning allows the driver to take instant actions and navigate back to the lane. Moreover, the Lane Keeping System (LKS) responds through a gentle intervention in the steering, which the driver can counteract at any time. This can save extra time to react properly where each and every second counts.

Blind Spot Detection (BSD)

Generally, a quick look at the inside and outside mirrors, possibly even a momentary glance over the left shoulder, we pull out to overtake and then a major fright happens when there is loud hooting from our left. As we fail to see the car approaching quickly from behind in the left-hand lane or in the blind spot next to our own car easily happens, particularly in a heavy traffic on the multi-lane freeways or highways and in urban traffic as well. The Blind Spot Detection System (BSDS) can monitor this area and take much of the worry off the driver and avoid dangerous situations. Blind spot detection warns the driver about cars that are approaching from the rear or cars that the driver is currently overtaking. The system uses a camera in each rear view mirror and these cameras are pointed at the so called Blind Spot, meaning the area alongside of the car which is hard to monitor by the outside mirrors. When another vehicle enters the monitored zone, a lamp comes on, in the relevant mirror. The driver gets a clear indication that there is another vehicle in the risk zone and can keep away. The system provides information about cars approaching from the rear and also vehicles in the front that the driver is currently overtaking. This information gives the driver added scope for taking the right decision in such situations. Both sides are monitored in the same way. The system is designed to alert the driver to vehicles that are moving a minimum of 20 km/h slower and a maximum of 70 km/h faster than the driver's own vehicle. This system can now be found in the cars, such as new Volvo S80, XC90 and V70. 125 The above described function can be realized with the following technology. Short Range Radar – SRR: SRR monitors the blind spot as well as the area behind the vehicle and can therefore help to prevent accidents when changing lanes.

Collision Warning Systems: Pedestrian Detection System (PSD):

Collision warning systems provides information about possible collision to the driver, but it remains up to the driver whether to use that information and what action to take. Pedestrian Detection System supports drivers to identify a person near or on the road. These systems have to work in all whether conditions and at night. Also, they must be potent enough to differentiate pedestrians from other objects near the road. One example is BMW Pedestrian Warning system. It works during the day and uses a standard camera but will also apply brakes in case of an emergency, to avoid collisions. The system can be deactivated manually. If the system is active, the driver can see a check mark next to its icon. A camera feed on car's navigation screen is triggered pressing a button located under the lights switch, to the left of the steering wheel. If a pedestrian come in the car's path, the driver receives an audible and visual important warning in the instrument cluster.

Sleepiness Warning System:

Industrial Technology Research Institute(ITRE) has even used the ultra-wide bandwidth (UWB)technique to integrate low power pulsed electromagnetic(EM) waves to precisely measure the driver's physiological signals such as his heartbeat and respiration etc. It is also through the development of various system algorithms to detect driver's psychic status.

Adaptive Light Control Systems:

This set of ADAS includes at the moment Adaptive High Beam Assist, Inter Urban Light Assist, Map supported Frontal Lighting, Partial High Beam Assist. A light-beam controller is used to support drivers in controlling vehicle's beams increasing its correct use, since usually drivers do not switch between high beams and low beams or vice versa when required. The adaptive light controller manages the spinning modules so that they always provide the perfect light for interurban, urban and highway driving. In AUDI adaptive light system, a video camera mounted in front of the inside mirror identifies preceding and approaching vehicles by their lights. The system adapts the vehicle's own light through a smooth range that always provides the maximum possible brightness. , For example, in the AUDI solution the headlight control is coupled with the navigation system, which reads the route data in advance and transmits them to the light computer, so as to trigger the longer-range highway lighting while still on the on-ramp to the highway. The system automatically switches on the cornering light before entering an intersection. The high-beam assistant is available in many Audi models, which uses a small camera in the rear view mirror. It detects upcoming vehicles and towns based on their radiance and switches automatically between the high and low beams. From the interaction point of view the driver can control the function of the adaptive light in the Audi drive select.

Park Assistance System (PAS);

Parking Assist System (PAS), helps drivers in parking their vehicle via an in dash screen and button controls. The car can navigate itself into a parking space with 133 slight input from the driver. The first solution in the market had been introduced by Toyota. In the Toyota Lexus system, the driver is accountable for checking to see if the symbolic box on the screen correctly recognizes the parking space. If the space is large enough to park, the box will be green in color; if the box is incorrectly placed, or lined in red, using the arrow buttons moves the box until it turns green. Once the parking space is correctly identified, the driver confirms and take his/her hands off the steering wheel, while keeping the foot on the brake pedal.

Night Vision System (NVS:

The information on NVS partially overlaps with paragraph 6.2.1 on pedestrian detection. Anything that generates heat such as a person, an animal and to some extent trees and bushes can easily be monitored on the display. NVS makes it possible for the driver to discover an object much sooner. The system can be also found in cars like BMW, and Cadillac. Thanks to an infrared camera, mounted in the front of the car, the driver can when driving in the dark, discover a human being or an animal up to 300 meters away. While driving at the speed of 100 km/h, the driver can determine a person up to five seconds before s/he is light up by the cars headlight. The extra five seconds could potentially help the driver to increase the safety margins and decrease the stress. The image section also follows the road even in curves and objects far away can be enlarged. The NVS can be accomplished in different forms, such as infrared headlamps and thermal imaging cameras. Most common way out is the infrared.

Hybrid vehicle:

A hybrid vehicle uses two or more distinct types of power, such as internal combustion engine to drive an electric generator that powers electric motor. Hybrid electric vehicles are powered by an internal combustion engine and an electric motor, which uses energy stored in batteries. A hybrid electric vehicle cannot be plugged in to charge the battery. Instead, the battery is charged through regenerative braking and by the internal combustion engine.

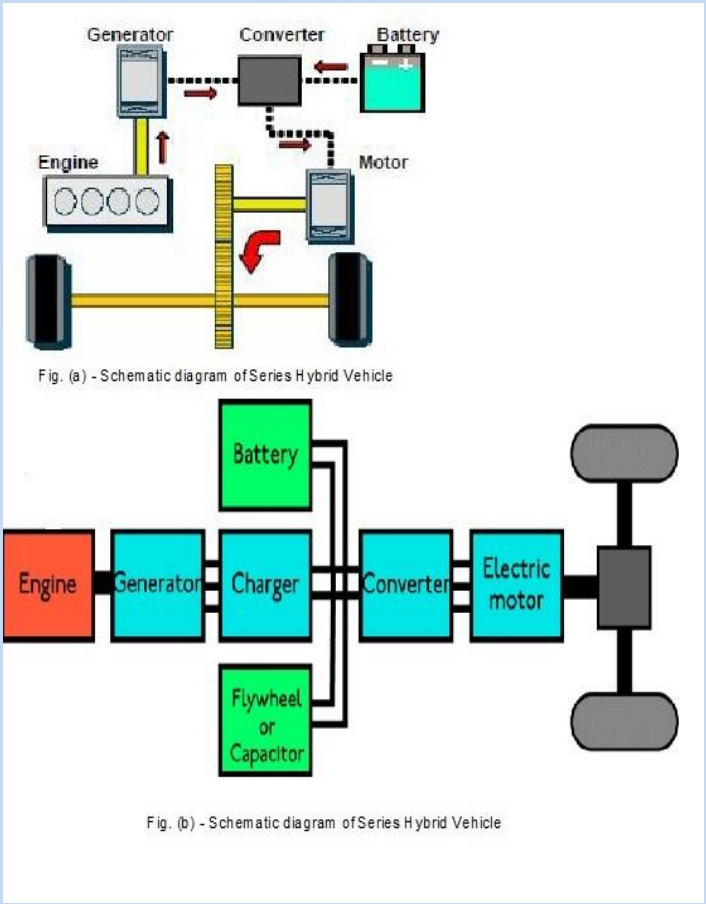
Types of Hybrid Car

There are mainly two types of hybrid cars – Series and Parallel. They differ in the manner in which the two energy sources are combined.

The series hybrid has the generator driven by the engine. This generator is used to charge the batteries and also drive the electric motor, which drives the transmission. Thus power to the vehicle is never directly given by the engine.

Parallel hybrid, on the other hand has both the engine and the electric motor to drive the transmission at the same time. This transmission is then used to turn the wheels. The fuel is given to the engine and the motor is supplied power by the motor. Parallel hybrids are considered straight forward, and hence are used widely. Take a look at the block diagram of a Hybrid Car.

Schematic Diagram of series hybrid car



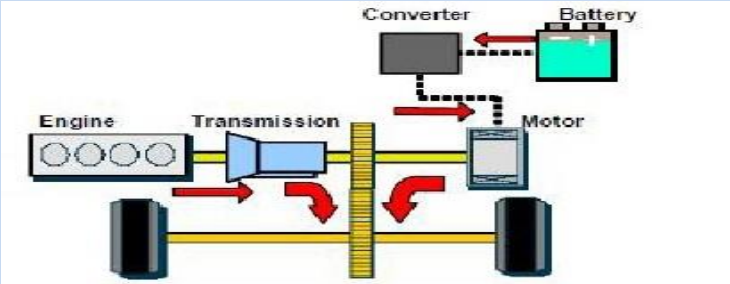


Fig.(a) - Schematic diagram of Parallel Hybrid Vehicle

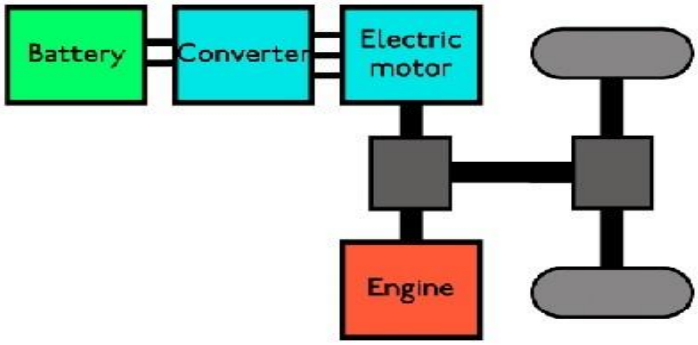


Fig.(b) - Schematic diagram of Parallel Hybrid Vehicle

Conclusion:

We have seen an increased number of features in vehicles and also the user interaction in–car has become overcrowded and more complex. As a result, driver distraction is growing and the number of accidents due to distracted driving is also increasing. The driver distraction in the smart car cockpit and other nomadic devices could grow even more in the future with more technology. Providing one more feature in the car might increase comfort and convenience but it can even lead to dangerous safety concerns if proper use cases and scenarios are not tested for the kind of distraction it can cause. The current state of technology is focused on the features oriented design and the sales driven approach. The in-car voice recognition is anticipated to be the solution to minimize the physical distraction, but there are a few challenges and limitations with respect to in-car environment and cognitive load. Most of the automotive manufacturers are focusing on making speech-recognition better, but it is not perfect. This faulty voice recognition system can even lead to unnoticed and more dangerous distraction if proper care is not taken while designing new interfaces with the voice interaction. MMIS and ADAS with focus on user entered design could help improve interaction while minimizing the distraction. Lastly, in order to compete with the market we cannot reduce the basic features that are provided by all the other competitors but we can try to make driving a bit safer by improving the in-car user interaction.

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