



**SAEINDIA**  
SAE INDIA NIT Durgapur - Collegiate Chapter



# AUTOPIA

*the annual automotive magazine*

SOCIETY OF AUTOMOTIVE ENGINEERS COLLEGIATE CHAPTER NIT DURGAPUR

**YEAR 2016**





# P R E F A C E

This annual automotive magazine is brought to you by SAE or Society of Automotive Engineers NIT Durgapur Collegiate Chapter started in 2007, with the motive of providing a boost to the automotive culture here. It brings together not just the mechanical department, but in fact all the branches to come and share a common platform of rigorous and consistent learning through workshops, guest lectures and events. SAE NIT Durgapur has been a good performer in SAE BAJA and EFFICYCLE organised at national levels. The annual automotive fest Motor Zundung represents the strength of the society and keeps alive the spirit of automobiles here.

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SAE India collegiate Chapter of NIT Durgapur was conceived in 2007 with an idea to integrate the students of the college into the international fabric of automobile engineering. It conducts a unique auto fest "MOTOR ZUNDUNG" which is the largest Auto fest of Eastern India. Currently SAE NIT Durgapur has also marked its entry into the world of automotive sports through BAJA SAE & Efficycle.

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DESCRIPTION

An autonomous car (driverless car) is a vehicle that is capable of sensing its environment and navigating without human input. Autonomous vehicles detect surroundings using RADAR, LIDAR, GPS, and odometer and computer version.

Advanced control system interprets sensory information to identify appropriate navigation paths as well as obstacles and relevant signage. Autonomous cars have control systems that are capable of analysing sensory data to distinguish between different cars on road, which is very useful in planning a path to the desired destination. The first self-sufficient car ap-

peared in the 1980's with Carnegie Mellon University navlab.

In the United States, the National Highway Traffic Safety Administration (NHTSA) has proposed a formal classification

system

- Level 0: The driver completely controls the vehicle at all times.
- Level 1: Individual vehicle controls are automated, such as electronic stability control or

automatic braking.

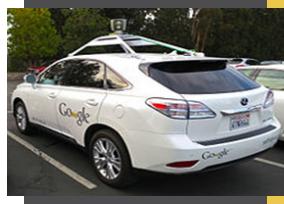
- Level 2: At least two controls can be automated in unison, such as adaptive cruise control in combination with lane keeping.
- Level 3: The driver can fully cede control of all safety-critical functions in certain conditions.

Example: Tesla Model.

- Level 4: The vehicle performs all safety-critical functions for the entire trip, with the driver not expected to control the vehicle at any time. As this vehicle would control all functions from start to stop, including all parking functions, it could include unoccupied cars.
- An alternative classification system based on five different levels (ranging



Top: A ROBOTIC VOLKSWAGEN PASSET, Bottom: GENERAL MOTORS FIREBIRD 2



## GOOGLE SELF DRIVING CAR: developed by Google X

Google self-driving car is any in a range of autonomous cars.

Google self-driving car is any in a range of autonomous cars, developed by Google X as part of its project to develop technology for mainly electric cars. The software installed in Google's cars is called Google Chauffeur. The state of Nevada passed a law on June 29, 2011, permitting the operation of autonomous cars in Nevada, after

Google had been lobbying in that state for robotic car laws.

**TECHNOLOGY:** Google's robotic cars have about \$150,000 in equipment including a \$70,000 LIDAR system. [17] The range finder mounted on the top is a Velodyne 64-beam laser. This laser allows the vehicle to generate a

from driver assistance to fully automated systems) has been published by

SAE, an automotive standardisation body.SAE, an automotive standardisa-

# Ather e-Scooter S340: India's own Smart e-Scooter...!!



India's Bangalore based start-up company Ather Energy is developing an electric two-wheel scooter – the Ather e-Scooter S340. The futuristic looking Ather S340 e-scooter is India's first smart electric scooter featuring an Android-Tablet based Dashboard. With the android tablet, the rider can view information on power, battery drain, system temperature, distance to the next charge-up and navigation. The tablet can also help track the scooter in case of theft. Ather Energy, which is founded by IIT-Madras alumni Tarun Mehta and Swapnil Jain, is located inside the IIT-Madras campus.

## FEATURES

Ather S340 is powered by a lithium-ion battery pack, which has a life of 50,000 km/s. Ather engineers have focussed on weight reduction; thereby optimising the weight to improve its efficiency. Ather e-scooter's size is similar to that of any 100cc scooter in the market. However, Ather e-scooter is 20% lighter than the other scooters in the market. The e-scooter also provides for enough space to store two full-sized helmets.

The S340 is not just electric but also adds few smart connected elements to it. It comes with a touch-enabled dashboard which integrates cloud-based to personalise the consumer's driving experience. It also embeds user profile based sign in like smartphones and has on-board navigation.

Ather e-Scooter poles apart because of its performance. The current prototype is able to attain 0-60 in just 11 seconds with a top-speed of 75 km/h, as claimed by Ather. The engineers have also been able to reduce the charging time of the e-scooter to a record 1.5 hours, whereas a typical e-scooter in the market takes upto 6 to 8 hours for a full charge. Ather e-scooter consumes only 2.5 units of electricity for total charge-up, as claimed by the company. Although there are preliminary readings, they may improve in the final product when it is ready for the launch.

The Indian automobile industry is among the Top-5 industrial sectors in India, according to the Annual Survey of Industries – FY 2013, and engages almost 6% of the country's manpower. The industry has grown steadily over the past decade driven by economic growth, rising per capita income, low penetration levels and improving accessibility. Over the past five years (i.e. FY 2011-15), the total production of automobiles, including tractors and mining & construction equipment, in India (including exports) have grown at a CAGR of 6.8%. Across segments of the industry, India is positioned amongst the

In volume terms, India ranks as the largest market for two-wheelers as well as tractors. It is also among the Top-5 and Top-10 markets for Medium & Heavy Commercial Vehicles (M&HCVs) and Passenger Vehicles (PVs), respectively. Besides favourable growth prospects, India's favourable Foreign Direct Investment (FDI) policy, relatively low cost of manufacturing, adequate manpower pool has also attracted several foreign original equipment manufacturers (OEMs) of the industry to invest in India and set-up manufacturing footprint. Today, virtually all the major foreign OEMs across segments of the industry have presence in

### Exports form a key part of foreign OEMs plans for India

Apart from setting their eyes on the relatively untapped domestic potential, OEMs' investments have also focused on leveraging India's cost competitive manufacturing base and export vehicles out of India. In this context, the passenger vehicle OEMs have taken the lead so far. To give a perspective, till FY10, Maruti Suzuki and Hyundai accounted for over 95% passenger vehicle exports from India. This trend is further supported by the fact that many of the OEMs are currently investing in new Greenfield facilities, up in

locations like Gujarat and Andhra Pradesh which are closer to the ports. In ICRA's estimates, nearly Rs 180 billion of Greenfield projects are currently in execution, or likely to start in the passenger vehicle segment alone. In the commercial vehicle segment, while there is only one Greenfield project under development (Rs 30 billion), most other OEMs are focusing on new model development again, with the focus on exports.

Foray of foreign OEMs have helped strengthened Indian auto component manufacturing base but we are still net importers

The foray of global automobile OEMs in India

**While auto component exports have grown steadily over the past five years (i.e. 14%), India continues to be a net importer of auto components. We believe this scenario is primarily explained by three factors –**

a) Lack of an efficient ecosystem to support low-cost manufacturing of electronic componentsGoogle had been lobbying in that state for robotic car laws.

inadequate critical mass of select models, making domestic investments unviable, and

b) Continuation of dependence of OEMs (on their global suppliers) for certain high-value critical components like engine and transmission parts, airbags, etc. due to

c) Growing penetration of cheaper imported tyres, especially for the after-market segment.●

leading markets, globally, providing adequate base for scale benefits in manufacturing.

the Indian market

even when the domestic market is yet to recover completely. Further, most of the incremental investments are coming up

has also benefited the country's auto component manufacturing industry. From encouraging the formation of joint ventures

(with their foreign suppliers) to increasing the sourcing of components locally, foreign OEMs have played an important role in strengthening the capabilities of the Indian auto component manufacturers. As a result, many of the OEMs have managed to achieve fairly high level of localization (in some cases as high as 90%), and reduce dependence on costlier imported components over the past few years. This, coupled with the fact that some of them have also started sourcing components from Indian suppliers for their global requirements, is a reflection of the improving technical and quality standards of India

suppliers. India's 'Make in India' campaign can help in encouraging local manufacturing of electronic-based components by offering fiscal incentives considering manufacturing of semi-conductors/electronics is generally capital intensive in nature.

### **The 'Make in India' campaign certainly a positive but needs to address a host of challenges**

While the government's 'Make in India' campaign is likely to attract investments from both domestic as well as foreign OEMs, the policy framework will have to encompass a comprehensive range of reforms to improve India's attractiveness vis-à-vis other automobile hubs. Globally, most of

the major automobiles hubs (i.e. Japan, South Korea, Mexico, etc.) have gained prominence not just on the back of favourable growth prospects locally, but also driven by export-friendly policies. Factors such as signing of Free Trade Agreements (FTAs), flexible labour reforms, transparent taxation policies and efficient infrastructure have collectively helped countries in emerging as global manufacturing hubs. In addition, strategic location in proximity to an important automobile market has also helped some nations in gaining competitive advantage. For instance, while Mexico exports almost 80% of the cars produced in the country, nearly two-third of those are sold in the United States.

In India, automobile OEMs have faced challenges due to inadequate

availability of railway logistics, basic utilities, and the lack of clarity or changes in the tax regime. All of these factors have adversely impacted their cost structure. For instance, most of the vehicles are transported via roads in India, which adds to the logistics cost. In some cases, changes in taxation policies (like VAT incentive in Maharashtra, uncertainty in computation of excise duty) have delayed the break-even period for some OEMs. In addition, power shortages have also adversely impacted the cost of operations, especially for energy-intensive operations such as die-casting, forging etc. This has propelled both, OEMs and ancillaries to invest in renewable sources of energy and purchase power through energy exchanges. While the government's focus on improving road, railway and power infrastructure will yield results only over a period of time, the industry could benefit from earlier resolution of labour and land acquisition reforms.



There're more than hundreds of factors on which designing of a car depends. But, There are broadly 3 parameters on which designing of a car mainly depends and a failure of any one of the factors make your car bulky, unstable and out of the track. I know, you're really excited get to know about the factors.

#### Here're the factors:

- (i) Car's C.G height
- (ii) Polar M.I of a car and
- (iii) Mass of car along with the Normal reaction exerted by the ground on a car.

As you see, these three factors look like simple and nothing seems new in that, but if the new and inexperienced designers forget any one of the factor and makes his car undesirable! It's interesting to know, the conditions on which these parameters give a best possible result.

So, let me tell about the conditions:

(i) C.G height should be minimum to make the car stable. The lower the CG height, the lesser wheel loading shifts to the front during braking, to the rear during acceleration, and to outside wheels during cornering. Racing Engineers strive for the minimum C.G height because a set of tires delivers maximum traction as all tires carries fair share of total dynamic load and therefore optimal performance of a car.

(ii) Polar M.I should be less so that turning of a car will be fine and smooth. However, It depends on the engine instalment in a car and thus the weight distribution on the front and rear side of a car.

(iii) Mass should be less but has to increase in Normal Reaction exerted by ground/track on a car and this is ap-

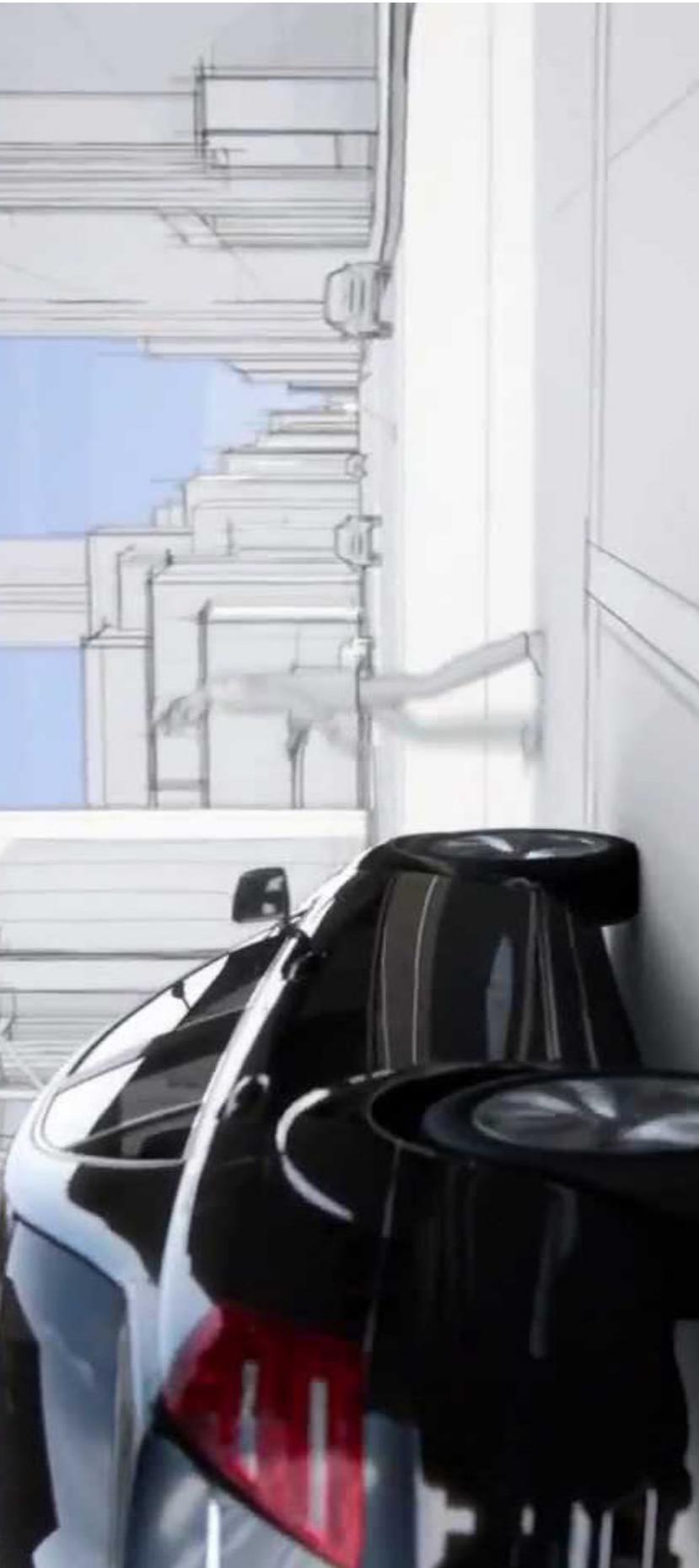


plicable mainly for high-performance cars and F1 cars where aerodynamic drag forces and down forces plays an important role.

Thus, these three basic parameters are the most important considerations during the design period of a car, which makes your car Desirable!

#### DESIGN FACTORS

- (i) Car's C.G height
- (ii) Polar M.I of a car and
- (iii) Mass of car along with the Normal reaction exerted by the ground on a car.



## IMAGE RECOGNITION PROCESSORS

The TMPV7602XBG image recognition processor from Toshiba America Electronic Components, Inc. is suitable for monocular cameras used in advanced driver assistance systems (ADAS) and will help designers implement ADAS applications using a cost-optimized camera system with a small form factor. Featuring 13 hardware-based image recognition accelerators, the TMPV7602XBG incorporates ADAS features that will become part of the camera requirements for the European New Car Assessment Program in 2018. These include autonomous emergency braking, traffic signal recognition, lane departure warning/lane keeping assist, highbeam assistance, and forward collision warning. In addition, the processor supports such new applications as traffic light recognition and night-time pedestrian detection. ADAS applications are processed concurrently within a typical time window of 50ms inside the image recognition processor and with relatively low-power consumption due to the purpose-built hardware accelerators and media processing units. The processor integrates new, enhanced accelerators that provide higher image recognition accuracy than previous Toshiba devices, particularly in low-light and night-time conditions.



Mercedes-Benz showed off its fully autonomous F015 Luxury in Motion concept car in Las Vegas, while Buick, Chevrolet, Hyundai, Infiniti and Volkswagen all had concepts sporting advanced features in Motown. Many of these technologies are a ways off, but others are just around the corner, or even entering showrooms right now. The rate at which technology is changing personal transportation accelerates every year, which can make predicting the arrival of future car tech a dicey proposition. This had us wondering — what automotive technologies will go from science fiction to commonplace in just the next 5 years. Below is a list in an effort to identify the top 10 advanced car technologies we'll see in showrooms by 2020.

1. Autonomous Vehicle — Note it's not fully autonomous vehicle. Why? Because it will take more than 5 years before a car can drive anywhere, at all times, without human oversight. But by 2020 we'll have cars capable of being fully autonomous in certain circumstances, most likely rural interstates with minimal variables (and no inclement weather). Think early days of cruise control.

2. Driver Override Systems — This relates to autonomous technology, but it's different because it's the car actively disregarding your commands and making its own decisions. We've already got cars that will stop if you fail to apply the brakes. But by 2020 cars will apply the brakes even if the driver has the gas pedal floored. The rapid increase in sensor technology will force a shift in priority, giving the car final say — not you.

technology will force a shift in priority, giving the car final say — not you.

**3. Biometric Vehicle Access** — The switch we've seen in recent years from keys to keyless entry and start will be followed by a switch to key-fob-less entry and start. You'll be able to unlock and start your car without anything more than your fingerprint (or maybe your eyeball, but fingerprint readers are more likely than retina scanners). Sound a lot like the latest form of cell phone security? It should, because it's exactly the same concept.

**4. Comprehensive Vehicle Tracking** — Insurance companies, and some state governments, are already talking about fees based on how many miles a person drives. By 2020 insurance companies will offer a reduced rate for drivers that agree to full tracking of their behavior. I'm hopeful this technology remains voluntary, but do I foresee a likely future where insurance companies will require comprehensive driver tracking? Sadly, yes.

**5. Active Window Displays** — Head-Up Display (HUD) technology has come a long way from the dim, washed out green digits some cars projected on their windshields 20 years ago. But as good as HUD is in 2015, by 2020 we'll see active glass capable of displaying vibrant images. Imagine a navigation system that actually highlights the next turn (as seen from your perspective, through the windshield) as you approach it.

**6. Remote Vehicle Shutdown** — This technology already exists, with OnStar leveraging it regularly. In recent years the telematics company has shut down hundreds of stolen cars, ending police chases quickly and with little drama (though most drivers still don't know it can be done, even drivers with OnStar...). By 2020 remote vehicle shutdown will enter the social consciousness, negatively impacting nightly news ratings everywhere.

**7. Active Health Monitoring** — Ford Motor F +0.37% Company has previewed the idea of seat-belt or steering wheel sensors that track vital statistics, though the rapid development of wearable technology means most cars will just wirelessly pair with these devices (think cell phone for your body). Combine this with basic autonomous technology and you've got a car that can pull over and call paramedics when the driver has a heart attack.

**8. Four-Cylinder Supercar** — Ford just showed an all-new GT supercar using a twin-turbo V6. While it may rub traditional performance enthusiasts the wrong way, a lightweight V6 making over 600 horsepower will offer world-beating performance, especially if it's got a light, carbon-fiber body to pull around. By 2020 we'll see the first full-fledged, 200-plus mph supercar with a four-cylinder engine (cubic inches be damned).

**9. Smart/Personalized In-Car Marketing** — You're already getting Facebook, Twitter and Gmail ads based on your behavior. By 2020 the average car will be fully con-

nected to the internet, meaning your vehicle will provide marketers with a powerful set of metrics to customize their message. Hopefully these will manifest as an opt-in feature, but get ready for personalized, location-based ads in your car's display.

**10. Reconfigurable Body Panels** — The small SUV category is seeing increased demand these days, while truck sales grow by leaps and bounds. What if you could have both vehicle types in one car? Imagine an SUV with lightweight body panels and advanced motors that retract the roof and side glass into the lower body panels. Now throw in Chrysler minivan stow-and-go seat design and BAM! A truck and SUV in one vehicle. It could happen.

# Mercedes' latest safety innovation

One such new technology is the Mercedes' latest safety innovation that helps to reduce the severity of a collision using airbags that help stop cars.



Mercedes Canada In Red On Parking



In the technological world, the latest advancement is only as good as the next thing coming down the line. The auto industry is constantly bringing us new technologies, whether be it for safety, entertainment, usefulness or simply for pure innovation. So what's in store for future cars? Well, we don't know for sure, but based on what's currently being tested and what's on the road today, we have an idea of some new technology that will most likely make it into production. Some of it will help keep us safe, some will give us information like never before and some will let us kick back and just enjoy the ride.

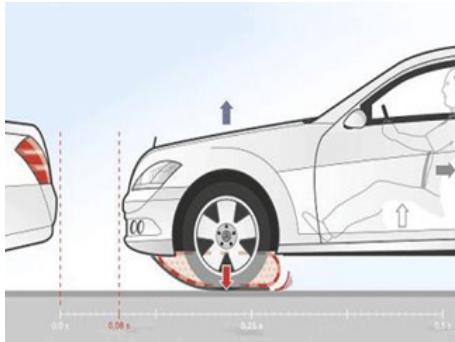
One such new technology is the Mercedes' latest safety innovation that helps to reduce the severity of a collision using airbags that help stop cars. Ever since airbags were been added to vehicles, they've continued to make their way around the inside of our vehicles. We now have curtain airbags, side airbags, knee airbags, seat belts airbags and even ones that deploy under us. Maybe all of us don't have them in our cars, but they're on the road. And Mercedes is working on a new way to use airbags that moves them away from

a passive safety measure and makes it part of an active safety system.

Mercedes is experimenting with airbags that deploy from underneath the car that will help stop a vehicle before a crash. The airbags are part of the overall active safety system and deploy when sensors determine that impact is inevitable. The bags have a friction coating that helps slow the car down and can double the stopping power of the vehicle. The bags also lift the vehicle up to eight centimetres, which counters the car's dipping motion during hard braking, improves bumper-to-bumper contact and helps prevent passengers from sliding under seat belts during a collision.

What gives this kind of airbag potential as a future technology is that it uses existing vehicle safety systems. Although Mercedes has been working on this technology for several years, it isn't available on any production models yet and may not be seen on the road for another few years.

With the current evolution of airbags and their pervasiveness within the automotive world, it wouldn't be a stretch to imagine future cars using airbags to not only protect passengers, but to actually stop cars as well.



# IONIQ



2017 Hyundai Ioniq offers three electrified power train



Hyundai unveiled the 2017 Ioniq at the Geneva Show, a car only available with an electrified powertrain. There will be three variants of the car, offering a conventional parallel hybrid, plug-in hybrid and battery electric drive.

Hybrid and plug-in versions use the new Hyundai/Kia Kappa 1.6-L direct injection gasoline engine announced in October 2015. The long-stroke engine uses Atkinson Cycle principals and cooled exhaust gas recirculation (EGR) to achieve a claimed 40% brake thermal efficiency.

According to company engineers, the engine's EGR rate exceeds 20%, with a 98% cooling efficiency for the EGR cooler and a 56.9-ms response time for the EGR valve. These three features are said to provide a claimed 3% gain in fuel economy. Hyundai claims that fuel savings are boosted by setting separate thermostat cooling temperatures for the block and cylinderhead, set at 105°C and 88°C, respectively.

Other details of the Kappa engine include six-hole laser-drilled GDI injectors and a 200-bar fuel system pressure. The engine is rated at 77.2 kW(104 hp) with peak torque of 147 N·m (108 lb·ft).

### 3 electrified powertrains

In the hybrid and plug-in hybrid variants, the engine is coupled with a 6-speed dual clutch automated transmission and the slim electric motor/generator is conventionally sandwiched between the engine and clutch. The motor is rated at 32 kW(43 hp) and produces peak torque of 170 N·m (125 lb·ft).

Electric power is supplied by a lithium-ion polymer battery of 1.56 kW·h capacity. Hyundai claims the Ioniq can achieve a maximum velocity of 185 km/h (115 mph). No official emissions and fuel consumption figures are currently available, but Hyundai claims target CO<sub>2</sub> emissions of 79 g/km or lower.

The same basic architecture is used

for the plug-in hybrid, but both battery and electric motor are upgraded. Hyundai claims battery capacity of 8.9 kW·h, using lithium-ion polymer chemistry again. The electric motor is rated at 45 kW(60 hp) and Hyundai claims range greater than 50 km (31 mi). CO<sub>2</sub> emissions are said to be as low as 32 g/km.

The Ioniq EV also relies on a lithium-ion polymer battery pack, rated at 28 kW·h. The battery can be charged from a regular domestic power point or fast charger. Hyundai claims that using a 100-kW fast charger, the battery can be charged to 80% capacity in 24 min. The motor is rated at 88 kW(118 hp) and drives the front wheels through a single-speed reduction gearbox.

The motor in all three Ioniq variants is of the permanent-magnet synchronous type, with the thickness of the electrical sheet steel core components reduced by up to 10%, claims Hyundai. Rectangular-section copper wire is also used to improve efficiency.

In all three models, the battery is located under the rear passenger seat. Battery electric variants carry more batteries under the spare wheel well. Up to 750 L of cargo space is said to be available in hybrid models and up to 650 L in plug-in and battery electric models.

## AERO AND MASS REDUCTION MEASURES

Hyundai states a 0.24 Cd drag coefficient for the Ioniq. To achieve this, the development team used a variety of techniques including front wheel air curtains, rear spoiler and diffuser, molded rocker panels, a cover beneath the car and closed wheel designs.

All Ioniq models are fitted with low rolling resistance Michelin tires on 15-, 16- or 17-in rims. Hybrid models with 17-in wheels are fitted with silica tires, which can combine good grip characteristics with low rolling resistance.

Weight reduction measures include the use of aluminum in the hood and tailgate, reducing weight by 12.3 kg (27 lb) compared with using steel. Other weight saving measures include the roller cover over the cargo space claimed to be around 25% lighter than similar covers in other Hyundai models.

Hyundai claims target CO<sub>2</sub> emissions of 79 g/km or lower.

The same basic architecture is used for the plug-in hybrid, but both battery and

Most are in the realm of safety, but some are pure convenience. Typically, innovative features from the manufacturers are offered on higher-end cars as options and eventually trickle down to less expensive vehicles as cost declines, awareness increases and demand grows.

Equipment and features the public takes for granted today- electric ignition, automatic windshield wipers, power steering, airbags, cruise control and many more began life as unexpected advances that dazzled the public. When GM introduced the first

automatic transmission -its Hydra-Matic Drive -in the 1940 Oldsmobile, it was a \$57 option and more of a curiosity than a "gotta-have" feature. Today automatic transmissions have advanced

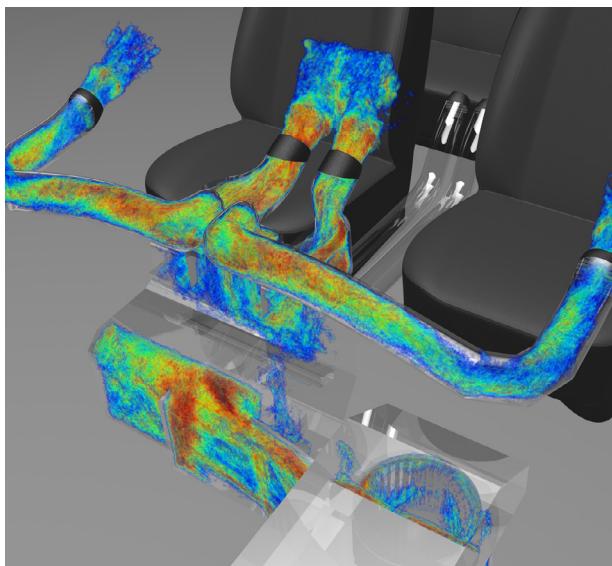
to the point of providing as many as eight forward gears, driver-shift options, computerized driver-adaptable shifting and different shifting modes, such as "sport," "touring" and "snow."

But in 1940, not stirring the transmission yourself was a radical concept and only well-heeled risk takers ponied up the extra cash for the new technology

Today's "cutting edge" is tomorrow's "common-place." Here is a collection of technologies already offered that could be mainstream just a year or two from now.

8 great new car gadgets:

1. Rear-mounted radar.
2. Night vision with pedestrian detection.
3. Automatic high-beam control.
4. Parental control.
5. GPS vehicle tracking.
6. Cameras.
7. Driver capability.
8. In-car Internet.



Predicting flow-induced noise in vehicle components and systems is now possible using new technology.



Techrules, a new China-based automotive research and development company, debuted last week at the 2016 Geneva International Motor Show .

# Bugatti Chiron



## Rear-mounted radar

Backing out of a parking space in a busy lot can be an adventure. Although rear-pointing radar has been around for a few years alerting drivers to unseen objects immediately behind them -- a fence, wall, tree or another vehicle -- new radar technology searches for approaching cross traffic. When it "sees" traffic approaching while you're backing up, it sounds an alarm. Chrysler's version is available in its minivans and is called Cross Path Detection System. It includes visual indicators in the outboard mirrors. Ford's system is called Cross Traffic Alert. released 2010 Fusion and Mercury Milan, it also has outboard mirror alarm indicators.

## Night vision with pedestrian detection

Although night vision in vehicles isn't a new technology -- Cadillac offered it in 2000 -- the Mercedes-Benz updated version is called Night View Assist Plus. Unlike the Night View Assist, which has been available in the S-Class since 2005, the new system pinpoints pedestrians, highlighting them on a dashboard display. It's offered in the 2010 E-Class

in showrooms late this spring. BMW has a similar system with a pedestrian identifier that also shows the direction the pedestrian is moving. As the distance closes between pedestrian and vehicle, a warning appears on the night vision monitor as well as the head-up display on the windshield if so equipped. BMW offers this system on the 2009 7 Series.

## Automatic high-beam control

In the redesigned RX, Lexus offers a system that automatically illuminates and dims the high-beam headlights in relation to approaching traffic. A camera mounted on the rear view mirror detects when the vehicle is closing in on oncoming traffic, as well as vehicles ahead traveling in the same direction, and disengages the high beams. Mercedes-Benz takes the technology one step further with its Adaptive High beam Assist. Also found in the new E-Class, it doesn't merely switch between low and high beams, but reacts by gradually increasing or lowering the light distribution based on the distance of approaching traffic. It also dims the high beams for

for sharp turns and then re-engages the high beams if there is no approaching traffic once the turn is completed.

## Parental control

Parents who are afraid their teen driver might speed or be distracted by playing the vehicle's audio system at an excessive volume can use Ford's new MyKey system to limit speed and volume. When programmed, MyKey limits the speed to 80 miles per hour. It can also be programmed to limit the audio volume and to sound a continuous alarm if seat belts are left unfastened. Eventually available in all Fords, MyKey is offered in the recently released 2010 Escape Hybrid and Mercury Mariner Hybrid.

## GPS vehicle tracking

Parents wishing to expand on the Big Brother theme can purchase the LiveViewGPS Live Trac PT-10. Retailing for \$550 with a \$40 per month subscription fee, it is a GPS tracking system that updates a vehicle's position every 10 seconds. Watching it live requires only Internet access. Small and portable, the tracking device can be moved from vehicle to vehicle. It can also alert parents through their

their cell phone if the vehicle's present speed threshold is exceeded or if the vehicle enters/ exits certain areas. It and similar Live View GPS products are also handy tools for businesses that need to track their fleet vehicles.

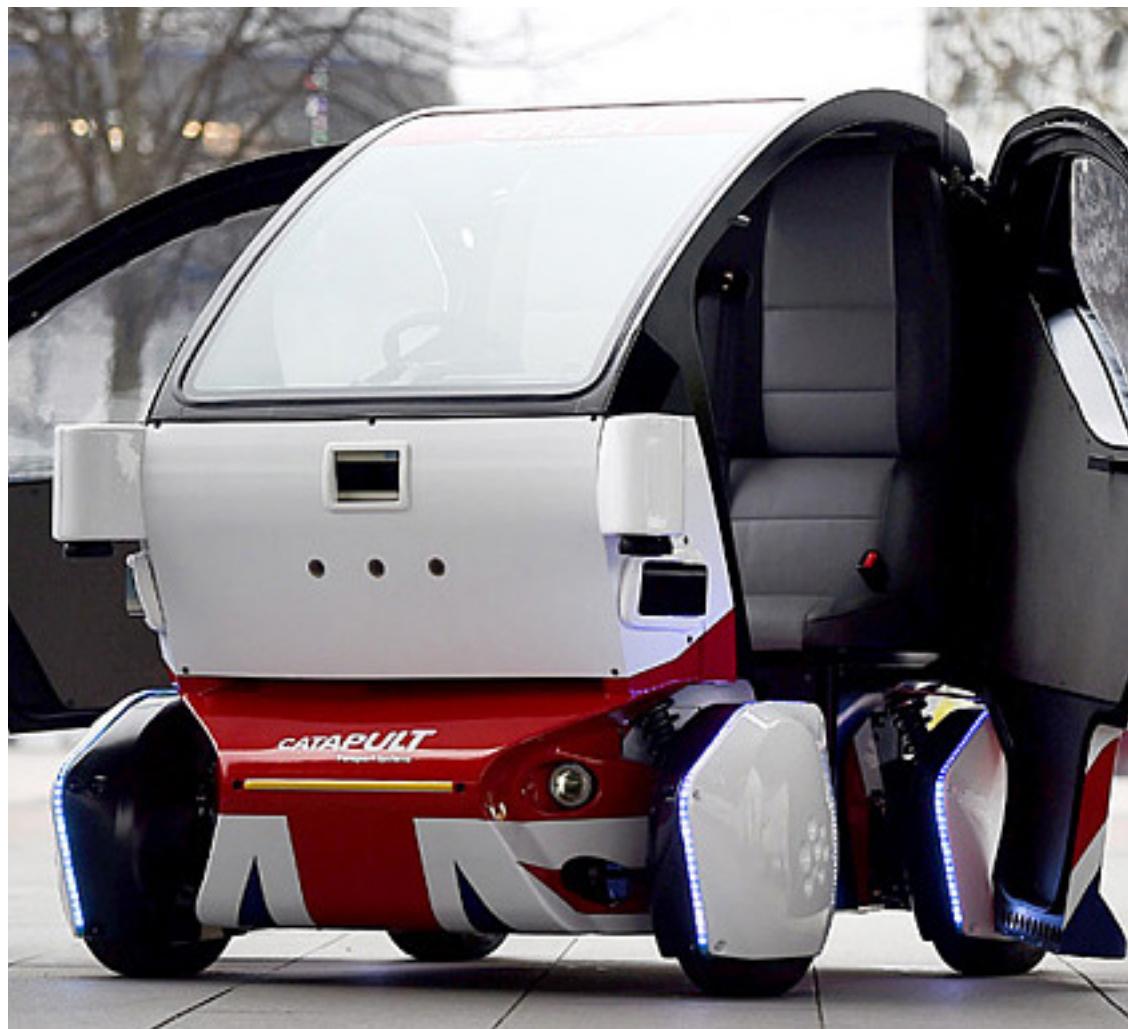
## Cameras

Not so many years ago there was an undeclared competition among vehicle manufacturers to see who could scatter the largest number of cup holders around a vehicle's interior. Now the competition seems to have switched to cameras. Camera systems that provide a view behind the vehicle when shifted into reverse are so yesterday. The new trend is toward multiple cameras providing enlarged fields of view. Available on its current 7 Series, BMW's Valeo -multi camera system employs three to five cameras, depending on the version, to display a panoramic view when parking. Precise distances are indicated by lines on the image. It also sounds an alarm when the vehicle closes in on an unseen object during the maneuverer. Infiniti's Around View Monitor has four wide-angle cameras mounted in

in the front, rear and sides, providing a bird's-eye, 360-degree view for parking purposes. Distances are illustrated by colour graphics, and a beeping alarm sounds when the vehicle closes in on an object. It's available on the EX35 and FX

### Driver capability

Although it might be beneficial to have a system that evaluates driver aptitude and shuts down the vehicle when incompetence is detected, we aren't there yet. But technology exists that measures a driver's fitness and issues warnings when a driver is judged overly tired or impaired. Attention Assist, found in the 2010 Mercedes-Benz E-Class, remembers a driver's normal behavior behind the wheel and establishes it as the driver's baseline profile. Continually measuring factors such as speed, lateral acceleration, steering wheel angle, pedal use and so forth, the system determines if there is any deviation from the baseline. If so, it alerts the driver visually and audibly that it's break time. Even external influences such as crosswind and road surface are factored in.



### In-car Internet

Although pure Wi-Fi Internet access from a moving vehicle is still in the future -- albeit the near future -- there are systems that allow for surfing using cell phone technology. The first system to turn your vehicle into a Wi-Fi hotspot is Autonet Mobile. Using a portable router mounted in the

trunk or other out-of-the-way location, this system uses a 3G network to supply an uninterrupted signal regardless of cell tower blind spots, tunnels and so forth. In addition to the \$399 router, there is a monthly subscription fee of either \$29 or \$59 based on estimated usage. Chrysler currently offers its U Connect Web

system in several models while Ford offers a system called Ford Work Solutions on the current F-150 pickup truck that primarily targets contractors. It dovetails several technologies into an integrated system that can complete a variety of tasks from maintaining your tool inventory to sending out invoices, creating spreadsheets and surfing the Internet.

A gear or cogwheel is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine. The teeth on the two meshing gears all have the same shape. [1] Two or more meshing gears, working in a sequence, are called a gear train or a transmission.

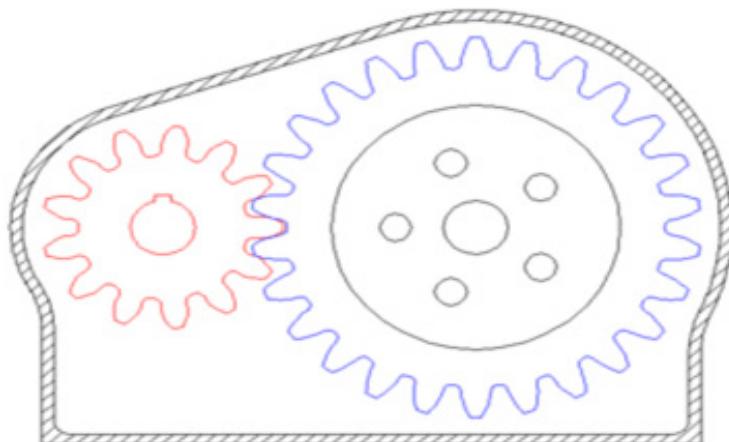
A gear can mesh with a linear toothed part, called a rack, thereby producing translation instead of rotation.

The gears in a transmission are analogous to the wheels in a crossed belt pulley system. An advantage of gears is that the teeth of a gear prevent slippage.

When two gears mesh, if one gear is bigger than the other, a mechanical advantage is produced, with the rotational speeds, and the torques, of the two gears differing in proportion to their diameters.

In transmissions with multiple gear ratios—such as

bicycles, motorcycles, and cars—the term “gear” as in “first gear” refers to a gear ratio rather than an actual physical gear. The term describes similar devices, even when the gear ratio is continuous rather than discrete, or when the device does not actually contain gears, as in a continuously variable transmission.



## HISTORY

Early examples of gears date from the 4th century BCE in China (Zhan Guo times - Late East Zhou dynasty), which have been preserved at the Luoyang Museum of Henan Province, China. The earliest gears in Europe were circa CE 50 by Hero of Alexandria, but they can be traced back to the Greek mechanics of the Alexandrian school in the 3rd century BCE and were greatly developed by the Greek polymath Archimedes (287–212 BCE). describes similar devices, even when the gear ratio is continuous rather than discrete, or when the device does not actually contain gears, as in a continuously variable transmission.

### Examples of further development include:

- Ma Jun (c. 200–265 CE) used gears as part of a south-pointing chariot.
- The Antikythera mechanism is an example of a very early and intricate geared device, designed to calculate astronomical positions. Its time of construction is now estimated between 150 and 100 BCE.
- The water-powered grain-mill, the water-powered saw mill, fulling mill, and other applications of watermill often used gears.
- The first mechanical clocks were built in CE 725.
- The 1386 Salisbury cathedral clock may be the world's oldest working mechanical clock.

# TYPES

## Spur gears-

Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Though the teeth are not straight-sided (but usually of special form to achieve a constant drive ratio, mainly involute but less commonly cycloidal), the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh together correctly only if fitted to parallel shafts.



## Helical gears

Helical or "dry fixed" gears offer a refinement over spur gears. The leading edges of the teeth are not parallel to the axis of rotation, but are set at an angle. Since the gear is curved, this angling makes the tooth shape a segment of a helix. Helical gears can be meshed in parallel or crossed orientations. The former refers to when the shafts are parallel to each other; this is the most common orientation. In the latter, the shafts are non-parallel, and in this configuration the gears are sometimes known as "skew gears".



## Bevel gears

A bevel gear is shaped like a right circular cone with most of its tip cut off. When two bevel gears mesh, their imaginary vertices must occupy the same point. Their shaft axes also intersect at this point, forming an arbitrary non-straight angle between the shafts. The angle between the shafts can be anything except zero or 180 degrees. Bevel gears with equal numbers of teeth and shaft axes at 90 degrees are called mitre gears.

# Maruti Vitara Brezza is the most fuel efficient compact



Maruti has launched the Vitara Brezza SUV in India. Arguably one of the most anticipated launches of this year, the Vitara Brezza is Maruti's entry to the sub-four-metre compact SUV segment.

Its proportions are what you'd expect from a compact SUV - 3,995mm long, 1,790mm wide and 1,640mm tall, with a 2,500mm wheelbase and an impressive ground clearance of 198mm. Less impres-

sive, however, is its boot capacity, which at 328 litres, is less even than what you get in Maruti's own Baleno hatchback. SUV segment. The new compact SUV is powered by Maru-

ti's tried and trusted 89bhp, 20.39kgm 'DDiS 200' 1.3-litre diesel engine from the Ertiga, Ciaz and S-cross, mated to a five-speed manual gearbox. As of now, there's no mention of a petrol engine op-

tion and there won't be one at the time of launch, but the Swift's 1.2-litre petrol and even the all-new 1.0-litre, three-cylinder Boosterjet turbo-petrol could be on the cards for later. There are talks of an AMT-equipped version, but that is expected to join the line-up later. The SHVS mild-hybrid system also won't be offered on the model.

A leaked brochure has revealed the fuel economy figure of the Vitara Brezza. Maruti's new compact SUV delivers 24.3kpl. Its direct rivals like the Ford Eco-Sport diesel deliver 22.7kpl and Mahindra TUV300 does 18.49kpl while the slightly larger SUVs like the Creta 1.4 and the Duster 85ps deliver 21.38kpl and 20.45kpl respectively. This means, the Vitara Brezza not only exceeds its direct rivals but also some of the larger players in the SUV category. It also beats its own big brother, the S-Cross 1.3 (23.45kpl) in the fuel economy race.

While the Vitara Brezza is available in a number of trims with different levels of equipment (detailed below), Maruti also offers it with three different exterior styling themes - namely Glamour, Sporty and Urban - each of which offers different contrasting colours and accessories on the outside and in.

# Something the innovative Ideators definitely need to look out for-

## The Valeo Innovation Challenge

So what exactly is the Valeo Innovation Challenge and how did I, being a third year mechanical engineering student, with a not so impressive general knowledge of the ventures going in and around my confined college life get to know about it?

Valeo is a multinational automotive supplier based in France, providing a wide range of products to auto manufacturers and after-markets. Now here is a brief insight on the company's impressive chronicle.

The Société Anonyme Française du Ferodo was founded in 1923 in Saint-Ouen, a suburb of Paris. It first distributed brake linings and clutch facings under license of Ferodo UK. The society engaged in a diversification in the 1960s by producing braking systems (1961), thermal systems (1962), and lighting systems (1970), and electrical systems (1978). In May 1980, the company was renamed Valeo, which means "I am well" in Latin. Valeo then engaged in an aggressive strategy of expansion, through many international acquisitions. Today, Valeo is organized into four business groups, namely Thermal systems, Visibility systems, Powertrain systems and finally Comfort and Driving Assistance Systems.

So what is this Valeo Innovation Challenge that I talk of? Valeo is offering young students worldwide the opportunity to make the car of 2030 and the way it's used more intelligent, intuitive, green and fun.

Comprising teams of two to five people, students from any discipline can take part by presenting a relevant, innovative project in English. The aim is to stimulate the students' creativity, enabling them to form multidisciplinary teams. The Valeo Innovation Challenge is part of Valeo's innovation strategy, supported by the company's annual Research and Development budget of over €1 billion. Selected teams (around 5 to 6 teams from a country, based on the number of registrations) get funded by the company to produce a prototype of the model/innovation/idea that the team submitted, and they also get an opportunity to present this prototype at the Paris Headquarters, fully funded by Valeo.

So whether you are that unmistakable inborn genius waiting for the correct platform to showcase your skills and ideas, or just a hopeless dreamer like myself who wants to try everything new and challenging, Valeo Innovation Challenge sure is something you can always have a shot at. Best part? They conduct it every year! Just keep an eye on their website for all the updates: <https://valeoinnovationchallenge.valeo.com/>

## Testimonials of the past winners (2015)

Team FalconView from Peking University in China won the 1st prize and was awarded a check for €100,000. The team proposed new algorithms that use a deep understanding of the road's structure to improve how vehicles' detect their surroundings. "By thinking about how human beings perceive a road's structure, we can make inferences about the road's appearance and geometry," team leader Yongkun Fang explains.

The team's vehicle detection algorithms use cameras, which could make the detection system needed for driverless cars more practical and affordable. "The jury was very impressed by this idea," says Devauchelle, who was on the jury. "The notion of providing extra information without any additional costs is absolutely exceptional."

## Team M.A.D.: Improving collision warning systems

Team M.A.D. from the Sri Aurobindo International Center of Education in India tied for 2nd place and was awarded €10,000. Their proposal for a collision warning system -- built on existing satellite systems and a new dedicated mobile app -- aims to make driving safer. "A person is killed in a car accident every four minutes, so our goal was to use technology to reduce the number of car crashes," says team leader Pranav Agarwal. Pranav and his teammate, Shubhankar Bhattacharya, spent six months working on their idea. "There were a lot of sleepless nights, and a couple of weeks of non-stop midnight testing," Shubhankar recalls. But the final result was worth it. "We believe that implementing this idea could save lives," Pranav says. "If we could save even one life, that would be the best reward!"

# AMT- THE HALF BLOODED TRANSMISSION

The dilemma between an automatic and a manual transmission is an age old issue among automobile buyers. Everybody wants the ease and comfort of an automatic with the power and economy of a manual. However, you can't have your cake and eat it too.

Or can you ?

Yes, thanks to the technological developments taking place, now you can actually get the best of both transmissions.

The Automated Manual Transmission or the AMT combines both the above two types to meet the demands of a modern car buyer. Under the skin it's just like a conventional manual transmission with the conventional gear box transmitting the power through a clutch plate. However, step inside the cabin, and you would be surprised to see clutch pedal missing. Yes that's correct. In an AMT you don't have to step on the clutch pedal or engage in frequent gear shifts during annoying traffic conditions.

This hectic task is being taken care by electronic sensors and actuators which changes the gears at the required time calculated through complex algorithms.

So when you are driving an AMT, it will feel like a usual automatic, however technically it has the same transmission parts as that of a manual. This way you can get the ease and comfort of an automatic along with the economy of a manual transmission.

Driving can be an unpleasant experience for those who are having a tough time syncing their clutching movements.

AMT solves this problem. There are other types of automatic transmissions available nowadays and automobile manufactures are gradually shifting from the normal automatic transmission to more advanced automatic mechanisms. Other such technologies include the CVT, DSG and the tectronic.

A DSG (Direct Shift Gearbox) is very similar to an AMT with just one underlying difference that it uses two sets of clutch plates (one for odd set of gears and one for even). An AMT may consist of one or two clutch plates depending upon the manufacturer. The primary advantage of a DSG is that it accounts for faster gear shifts with negligible delay. One set of clutch plate is engaged with the odd set of gears while the other is connected to the even set. This Gearbox uses a sensor which predicts the next gear and shifts it to that gear instantly. While one of the clutch's is disengaging the other clutch is engaging, thus reducing the power drop to a minimum

Another type of automatic transmission gaining popularity these days is the CVT or Continuously Variable Transmission. The most interesting part about this type of transmission is that it does not have a specific set of discrete gears. Usually cars have 4, 5, 6 or even 7 gears. However, a CVT has infinite gears. Yes, you read it right. It has infinite number of gear ratios. Its gear box consists of two pulleys of varying diameter connected with a belt. The position of the belt on the both the pulleys determines a gear ratio. And every position has a unique gear ratio giving rise to infinite gear ratios. The consistency of such engines is phenomenal as the gear box automatically adjusts to give the ideal gear ratio required at that engine speed.

The power loss is minimum which in turn increases the fuel efficiency. However, this technology is complex and expensive, due to which it isn't very popular in the non-commercial automobile sector.

The automobile technology is accelerating in the 5th gear and soon we will see even more advanced techniques of transmission. However, a true automobile enthusiast will never get tired of the age old manual stick. Manual transmission is still a favourite for many drivers as they want to have full control over the speed. Moreover, it is fairly difficult to perform stunts in an automatic. So doughnut lovers will always stick to a stick.



During the first half of the twentieth century, the automobile evolved from a marginal curiosity to the dominant mode of ground transportation in the United States. Automobile (or car) – wheeled passenger vehicle that carries its own motor. Most definitions of the term specify that automobiles are designed to run primarily on roads, to have seating for one to six people, typically have four wheels and be constructed principally for the transport of people rather than goods.



As of 2002 there were 590 million passenger cars worldwide (roughly one car for every eleven people), of which 140 million were in the U.S. (roughly one car for every two people). spawning a vast network of national interstate highways, spurring the postwar suburban sprawl, opening up unprecedented possibilities of mobility for the average American, but also spawning a host of stubborn social ills: air pollution, traffic jams, road rage, and even a major contribution to global climate change.

Car in 1886 and by 1891 had developed the automobile to the stage of commercial feasibility. In France, Emile Constant Levassor created the basic mechanical arrangement of the modern motorcar in 1891 by placing the engine in front of the chassis, making it possible to accommodate larger, more powerful engines. By 1895, when Levassor drove a car over the 727-mile course of the Paris-Bordeaux-Paris race at the then incredible speed of fifteen miles per hour, automobiles regularly toured the streets of Paris.



11<sup>th</sup> March - 13<sup>th</sup> March

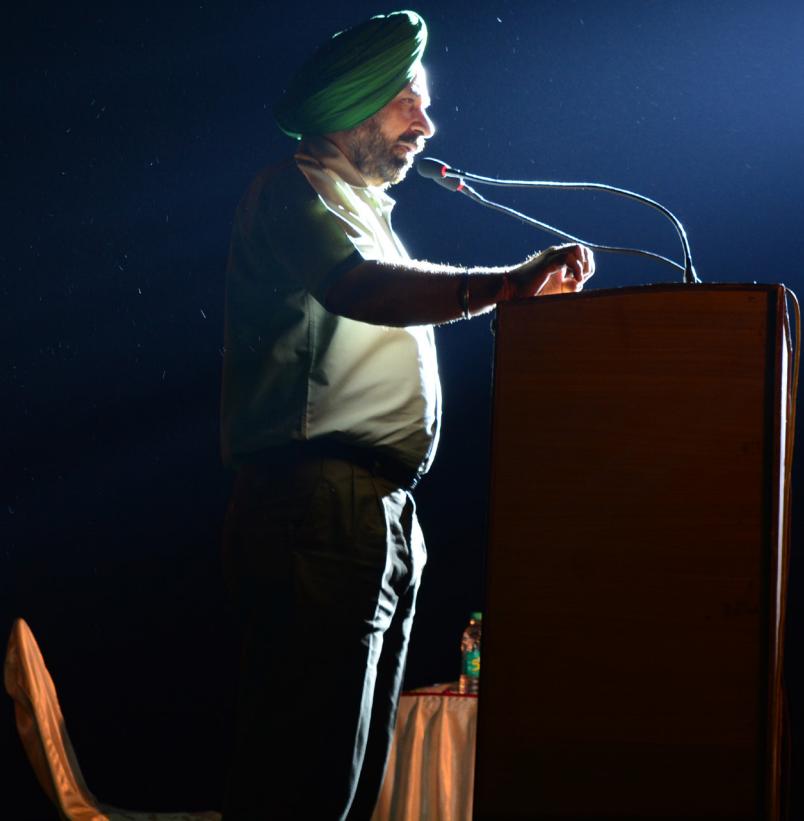
2016

# MOTOR ZUNDUNG



## ● THE ANNUAL AUTOMOTIVE FEST OF NIT DURGAPUR ●

- DEFENCE VEHICLE DISPLAY
- GUEST LECTURES
- QUADCOPTER WORKSHOP
- BIKE STUNT
- AND MANY MORE



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DEFENCE VEHICLE DISPLAY





**BIKE STUNT SHOW**  
Organised by SAE Collegiate Chapter NIT Durgapur







## SAE BAJA NIT DURGAPUR



BAJA OFF-ROAD VEHICLE MADE BY  
TEAM NDORS SAE NIT DURGAPUR

Baja SAE is an intercollegiate design competition run by the Society of Automotive Engineers (SAE). Teams of students from universities all over the world design and build small off-road cars. The cars all have engines of the same specifications. As of 2014 the engine has been an unmodified Briggs & Stratton Intek 20 single-cylinder with a displacement of 305cc and power output of approximately 10 bhp. The goal in Baja SAE racing is to design, build and race off-road vehicles that can withstand the harshest elements of rough terrain. The vehicles used in Baja SAE racing are often similar in appearance to dune buggies. In India, this event is run by SAE India.

There are multiple dynamic events, usually four per event, as well as a single four-hour endurance race. The dynamic events include hill climbs, chain pulls, maneuverability events, rock crawls, and suspension & traction events. Static events, such as written reports, presentations and design evaluations are provided by participating teams. This is when the teams are judged on ergonomics, functionality, and producibility of their cars; ensuring that the final placement of the team does not rest solely on the vehicle's performance but rather on a combination of static and dynamic events. Required reports detail the engineering and design process that was used in developing each system of the team's vehicle, supported with sound engineering principles.

Also, a cost report that provides all the background information necessary to verify the vehicle's actual cost is used to rate the most economically feasible for production. These reports are submitted weeks in advance of each event, where the presentations and design evaluations are given on site in the presence of SAE design judges.

In India the history of the BAJA can be tracked down to when the Delhi College of Engineering students participated in the Mini Baja in 2002 and this was followed up by other brave attempts by other institutions like VIT, SVNIT and RV College of Engineering who also took part in the subsequent editions of the international event. This interest was just what was needed

to set the ball rolling and the Society of Automotive Engineers in India (SAEINDIA). With Dr. KC Vora at the helm and Dr Pawa-Goenka, as the Chairman of the steering committee launched the BAJA SAEINDIA in 2007. As they ventured into uncharted territory of holding a mega-event of this scale, the Automotive research Association of India (ARAI) and NATRIP came forward to lend a helping hand through an earmarked zone at its upcoming proving grounds – NATRAX, situated at Pithampur, Indore. also saw a similar growth in numbers with 100 teams fighting it out in the main event. In 2012 too this tradition of growth was maintained as event gathers momentum with more and more colleges showing interest in taking part in the event.

With a healthy growth in interest and participation in the event each year the BAJA SAEINDIA is sure to only strengthen the next generation of automotive engineers and with international manufactures now focusing more and more on emerging markets this couldn't be better timing. Over the years Baja has grown in popularity and has become a bigger event nationally. It serves as a platform for young engineering talent to showcase their skills and acquire a real life experience while overcoming obstacle and challenges. The 9th edition of BAJA SAEINDIA in the coming year 2016 will be altogether a different scenario in terms of number of participants as well as level of vehicles.

This time BAJA SAEINDIA has received 390+ registrations from all over the country which is in itself a huge progress. Since its inception, BAJA has inspired many brilliant minds to come up with mind boggling innovations and developments and this time also BAJA will ignite the passion which will generate the spark to create a better version of vehicles.

Last year there were 18 teams for E-BAJA which has reached to 32 teams this year. This is a big step towards awareness among individuals about alternate energy sources and sustainable development. E- BAJA is a strong initiative and we look forward to work for the betterment of technology and environment.

## SAE BAJA NIT DURGAPUR

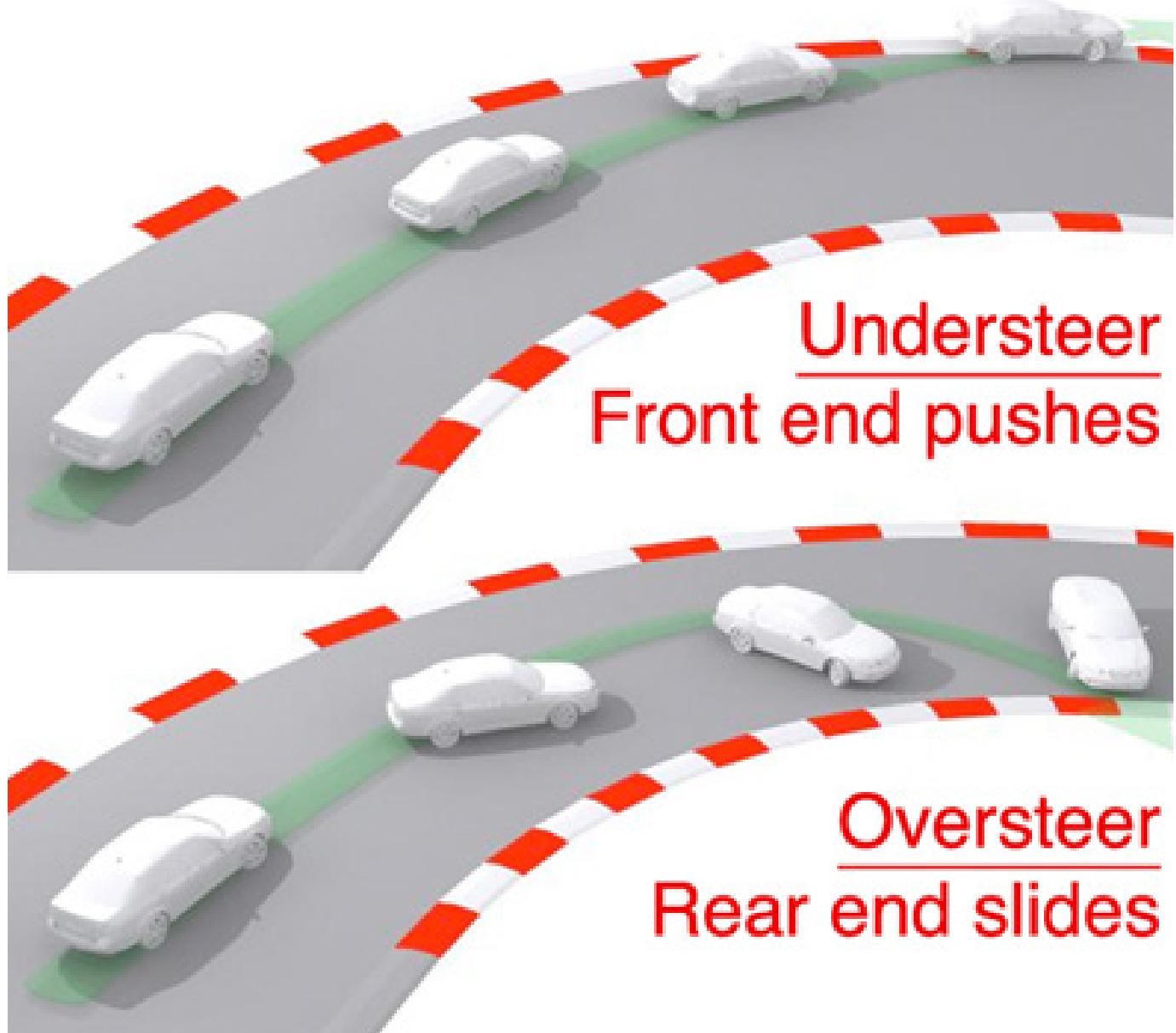
In our college, NIT Durgapur we have team NDORS (NIT Durgapur Off-Road Sports), which is the official BAJA team of NIT Durgapur. It designs and fabricates a baja buggy every year to participate in BAJA SAEINDIA. The students of the college themselves organize workshops about baja and fabricate the baja buggy from scratch, starting from the design of the vehicle to fabrication of its various components from the roll cage, transmission, suspension, to the braking and steering system of the vehicle. Then they participate in the baja virtuals and on qualification, race their buggy in the Pithampur race track in Indore.

-AAYUSH GUPTA  
3rd Year, MECH

# STEERING IN A BAJA VEHICLE

An equally important part or mechanism in the BAJA vehicle is the steering mechanism. Usually it is just same as the regular steering mechanism, tweaked for more endurance and stability. A BAJA vehicle which generally has a Rear Wheel Drive Mechanism has quite the same steering features as is encountered in a normal Rear Wheel Drive car when cornering hair-pins and tight corners. But because of the absence of electronic weight distribution system in BAJA vehicle it becomes a little tricky and intuitive when it comes to avoiding Understeer or Oversteer. What is Understeer or Oversteer? Understeer is the path followed when the front wheels that give direction have a small grip patch and thus resulting in poor manoeuvrability and the vehicle's inability to make the corner, while on the other hand Oversteer is the excess or more inward curving of the vehicle while cornering resulting from the loss of grip on the rear wheels or a more elegantly 'Drifting'.

Also since the BAJA vehicles have CVT transmission the weight distribution becomes gradual and thus preventing understeer in most cases. Another challenge in a BAJA vehicle is to avoid the kick back from the steering when the front wheels uncover a big bump. For this reason some BAJA All-terrain-Vehicles use power steering which counter-acts the feedbacks from the wheels. But this power-steering may or may not aid in manoeuvrability of the vehicle. An easy more cost-effective way is to avoid the big bumps on the tracks as far as possible since the addition of power-steering adds weight to the car which maybe undesirable when there is an angled climb at an angle of more than 25 degrees. So, there it is people all that steering has to do on a BAJA All-Terrain-Vehicle.



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