Driving in comfort

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How the latest innovations in electronics contribute to making automotive seat solutions more comfortable

Car electrification and semiconductor pervasiveness are key elements for innovation in traditional Automotive Body components. Among others, this trend is impacting car seats, where together with innovative and fashionable textiles and leathers, car manufacturers are investing in advanced features to enhance driving comfort. Moving from high-end to middle/low-end cars, feature like electric seat adjustment and seat cooling and / or heating are becoming new de-facto standards.

SEAT POSITIONING BASED ON BODY-TYPE CHARACTERISTICS

"Many people do not position their vehicle seat correctly. This can lead to back pain and stiff legs, particularly during longer journeys. The correct seat adjustment is important for safety. This relates not only to the effectiveness of the head restraints, but also to the interaction with the airbags and safety belts. Therefore, we have developed a technology that allows vehicle seats to easily be pre-adjusted automatically" said Dr. Andreas Eppinger (2014), group vice-president of technology management at Johnson Controls Automotive Seating.

The company has created a dedicated algorithm to compute best seat position starting from the driver's height only. The calculation generates an almost optimal position that can be further optimized by the driver himself. The implementation of this feature could take advantage of an app developed for modern smartphones that sends the computed seat position to the car via Bluetooth (or any other in-car available connectivity system). The seat adjustment subsystem then adjusts the seat before the driver sits down. A similar system could be implemented for passenger

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seats. The mobile app could also be substituted by a console interface in the car infotainment system to receive the height information and compute the correct seat position.

SEAT POSITIONING STRUGGLES IN CAR SHARING

Whether adjusted by an automatic algorithm like in the case above or manually, the seat position has to be adjusted every single time a new passenger or driver boards the car. To avoid the struggle of re-adjustment, the optimal position could be stored in a smartphone app (or in a NFC tag in the car keys) and retrieved automatically.

For example, by using motion sensors, the precise position could be detected and stored in a dual-interface EEPROM device. Transferred from the EEPROM to a smartphone via NFC, the computed position could be stored with a given user profile for future use. A small database of users and seat position is therefore created. From this moment on, any user having a seat position profile can request car system to re-adjust the seat even before boarding the vehicle by approaching the phone to the door lock and transferring the requested position via NFC.

SEAT ADJUSTMENT WITH GESTURE CONTROL

Since the 2016 Consumer Electronics Show, BMW and Volkswagen have brought gesture-driven interface systems into the market. At the beginning, these systems were limited to car radio and infotainment control, today this technology has expanded from only a few high-end business models down to family cars. The growth of these types of systems has been enhanced by the development of new technologies such as FlightSense™ (patented by STMicroelectronics), a ground-breaking technology that measures absolute distance independent of target reflectance.

Instead of estimating the distance by measuring the amount of light reflected back from the object (which is significantly influenced by color and surface), ST's solution precisely measures the time the light takes to travel to the nearest object and reflect back to the sensor (Time-of-Flight). The distance and signal level can be used by the host processing system to implement gesture recognition. Simple gestures like swipes can be detected by a single device, while more complex gesture patterns can be detected by paralleling three sensors. Gesture technology could be a valid complement to standard buttons for a more user-friendly experience in seat positioning.

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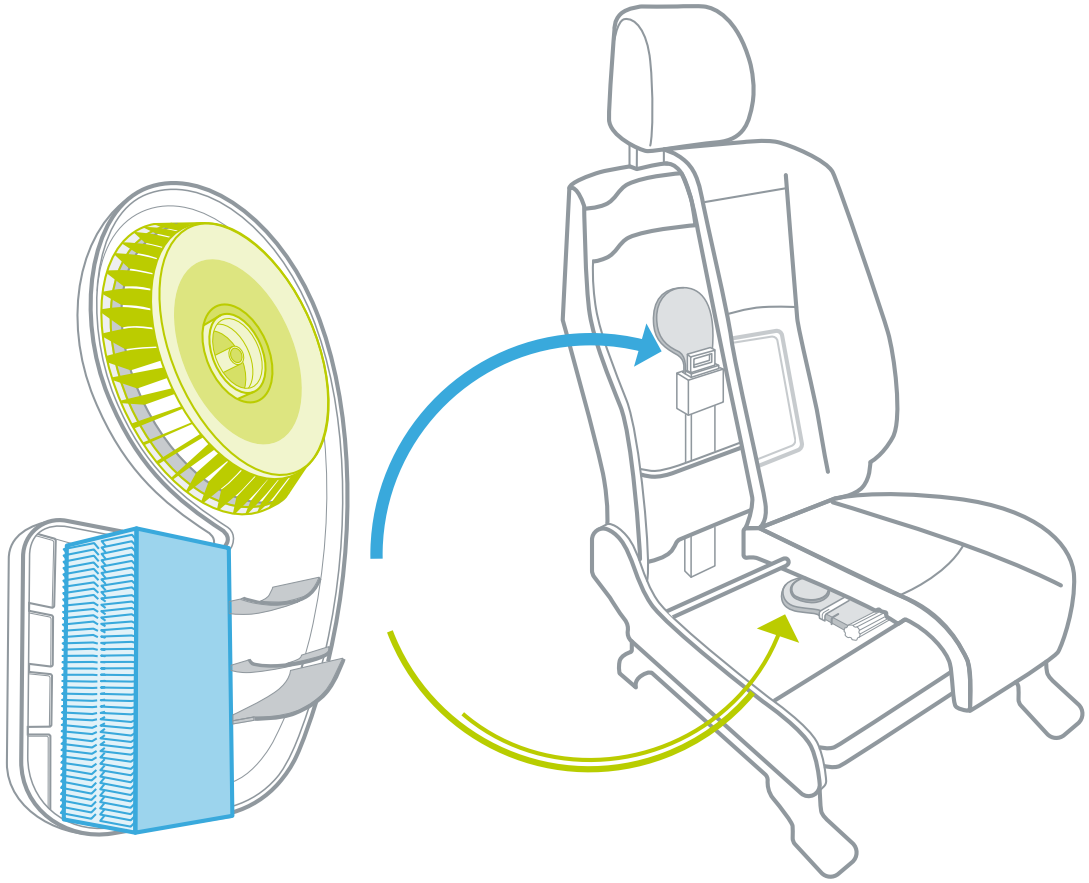
SEAT COMFORT WITH PRECISE ENVIRONMENT SENSING

Comfort can be further enhanced using a temperature adjustment system for the front seats. High-end aftermarket models feature true forced-air cooling and heating. Gentherm (formerly Amerigon) uses Thermal Electric Device (TED) technology and specially designed blowers. Cooled or heated air is forced through special foam and perforated leather, providing true air-conditioned or heated seating. The passenger and the driver will feel air moving, but not as strong as the air current felt from the car's AC system.

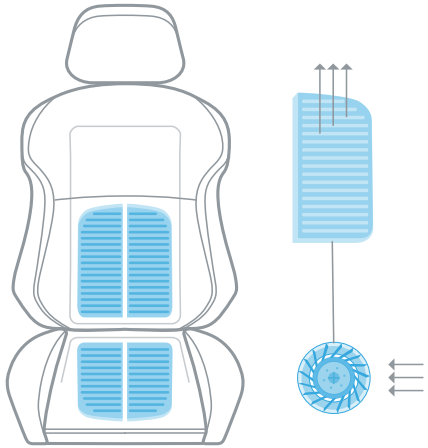
Gentherm's system has thermoelectric heat pumps in the back and bottom cushions. Conditioned air passes from the thermoelectric system through channels to the occupant, providing on-demand cooling or heating. The below image shows the heat pump consisting of a thermoelectric module (blue box) and a fan (green).

A similar approach is also proposed by Kia in which air is blown directly from the seat. It is designed to provide the same quality of ventilation as systems in more expensive cars at a lower cost. When the ventilated seat is activated, a motor inside the blower pushes out air via a duct to the seat cushion and back.



This controls the seat's temperature and dampness to provide greater comfort for the driver. The breathable seat offers three levels of ventilation which is controlled by the ECU. The system was successfully tested in a chamber at a temperature of 38 °C and 80% humidity, creating the highest level of discomfort.

For all the above solutions, two key electronic elements are required for implementing such systems: accurate and high reliable motor drivers and precise environmental sensors. ST is able to cover all requests offering BCD drivers and Low Voltage Mosfets for motor driving and a wide portfolio of temperature, humidity, ambient light environmental sensors.



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ST's product portfolio

ST's rich portfolio includes all components required for modern automotive seat solutions:

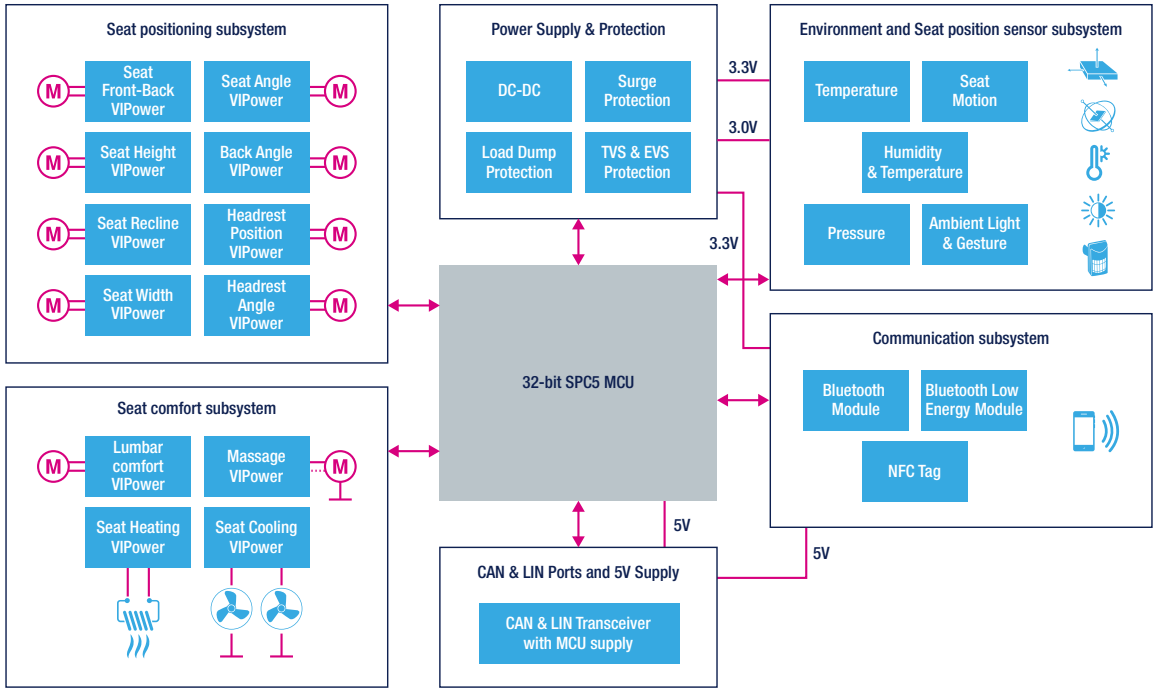
- An unrivalled family of high-side switches, VIPZero, based on proprietary VIPower® technology featuring an on-state resistance of only few mΩ, ideal for driving high-current seat heater loads

- A high safety dedicated sub-family of H-Bridge drivers based on proprietary VIPower® technology featuring patented Power Limitation technology and 15 A of current in a compact SO16N package ideal for driving seat positioning motors like seat movement, seat height, seat length, seat width, seat angle, back angle, headrest position, headrest angle, lumbar support, and massage;

  www.st.com/vipower

- A comprehensive family of 32-bit power Architecture MCUs for automotive body applications with a rich peripheral set and memory options;

  www.st.com/spc5



- 3-axis automotive-grade digital accelerometer and gyroscope sensors able to provide precise information about seat orientation and position;

  www.st.com/mems

- A rich set of environmental sensors to acquire information about humidity, barometric pressure, temperature and ambient light to auto-regulate seat heater and / or cooling fans and pumps;

  www.st.com/sensors

- Bluetooth, Bluetooth Low Energy and NFC communication modules to allow adjustment through smartphones;

  www.st.com/wireless

  www.st.com/nfc

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