

Advanced Manufacturing Technology (TechVision)

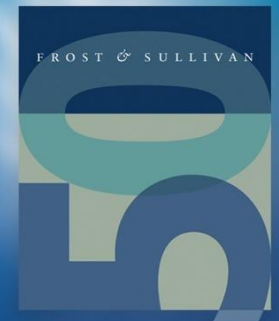
Heads-up Display (HUD) Technology in the Automotive Industry

“New Innovations in HUD technology Impacting the Automotive Industry”



D718-TV

February 26, 2016



Contents

Section	Slide Numbers
<u>Innovations in HUD Technology Impacting the Automotive Industry</u>	3
<u>BMW Motorrad–HUD Helmet</u>	4
<u>Visteon Corporation–Extra-Large Windshield HUD System</u>	5
<u>Cognitive AI Technologies Inc.–Carloudy</u>	6
<u>HeadsUP! Inc.–HeadsUP Interactive HUD Display</u>	7
<u>Analyst Perspectives</u>	8
<u>Key Patents</u>	9
<u>Industry Interactions</u>	12

Innovations in HUD Technology Impacting the Automotive Industry

Augmented Reality Heads-up Display (HUD) Systems

BMW Motorrad–HUD Helmet

Tech. Profile

BMW Motorrad (BMW Group) has developed a new helmet with a heads up display for motor cycles which has the capability to project the required real-time vehicle and road information in the rider's field of view according to the rider's selection, making the drive more efficient and safe for the motorist.

Innovation Attributes

The helmet consists of a camera used for providing real-time feeds from the rear of the vehicle to the motorist. The left hand side rear of the helmet is equipped with two batteries which can power the helmet for five hours. The helmet is also integrated with a wireless mini-computer and speakers.

Technology Readiness Level



At present, this technology is in the technology demonstration and system/sub system development stages.



Competing Aspects

A micro-controller is fitted on the left hand side of the handle of the bike and is used to wirelessly control the mini-computer and the speakers. The display can provide information regarding gear, temperature fuel level, speed of the vehicle and even road sign details and eliminates the need for the motorist to check the motorcycle's instruments.

Market Entry Strategies

BMW Motorrad has designed the HUD system in such a way that it can also be integrated into any existing helmet. The company will also be adding new features to the HUD systems and also to its motorcycles to improve the efficiency and driving experience for the motorist.

Impact & Opportunities

Wide-scale Adoption

- ✓ The HUD system developed by BMW Motorrad is still in the prototype stage. The company is currently working on improving the efficiency and optimizing the system's performance.
- ✓ This novel technology is expected to be commercialized around the end of 2018.

Market Opportunity

- The HUD system for motorcycles has potential to be adopted across various markets/applications.
- ✓ Transportation and safety
 - ✓ Automotive
 - ✓ Military and defense
 - ✓ Sensors
 - ✓ Smart cameras
 - ✓ Augmented reality

Technology Convergence

Augmented reality HUD systems can be expected to converge with other new and existing technologies such as sensors, digital dashboard, vehicle to x-communications, and will also pave the way for new application opportunities across various markets.

Large Field-of-View HUD System

Visteon Corporation—Extra-Large Windshield HUD System

Tech. Profile

The HUD system developed by Visteon Corporation is an extra large windshield HUD which projects large images with high precision and accuracy in color, brightness and contrast. With the use of data analytics, the HUD system will read the environmental conditions both inside and outside of the vehicle and accordingly display different real-time required information. The system is voice and touch controlled and can be used with ease.

Competing Aspects

The new windshield HUD systems are twice as large as conventional windshield HUDs. The instrument panel consists of a large mirror and a powerful backlight which changes the brightness of the display according to existing climate conditions for better, clearer and full-color resolution display.

Innovation Attributes

The HUD system will be constantly prompting and providing the driver with information related to the inside of the car as well as information regarding the outside environment. Information such as speed, lane change, road and climate conditions, music, phone, road sign and warning detection will be displayed and prompted by the system.

Wide-scale Adoption

The company is currently working on optimizing the performance of the HUD systems and will be collaborating with automakers in the Asian and European markets between mid 2016 and 2017.

Market Opportunity

- Automotive
- Augmented reality
- Sensors
- Digital dashboards
- Aerospace
- Military and defense
- Connected and smart transportation

Technology Convergence

Visteon Corporation is a global leader in the manufacture of innovative cockpit and connected car products and solutions. Due to the increasing requirement for advanced technologies to improve user mobility, experience and safety, this technology has opportunities to be widely adopted for different applications in the industries or applications mentioned above.

Market Entry Strategies

Visteon Corp. unveiled the HUD systems at the Consumer Electronics Show (CES) 2016, which took place during January 6 to January 9, 2016 in Las Vegas (USA). The systems will be used in entry-level luxury cars in the Asian and European automotive markets.



Wireless, Smart, and Cost-effective HUD

Cognitive AI Technologies Inc.–Carloudy

Tech. Profile

Carloudy is a unique electronic paper six-inch, high-definition semi-transparent HUD which projects information on the car's windshield. The device lasts more than two weeks on a single charge and uses an ambient light sensor to adjust the image brightness according to the brightness both inside and outside the vehicle.

Competing Aspects

The 6.0 inch high definition, semi-transparent display consists of an ARM processor which consumes less power. The device also has Bluetooth, USB and Wi-Fi options and weighs only 0.55 lbs

Innovation Attributes

The device is voice controlled and mainly provides key information such as navigation parking, finding nearby restaurants, information regarding when the vehicle needs a wash and also controls the music system.

Wide-scale Adoption

The company has started large-scale manufacturing of the Carloudy units and will be shipping the orders from April 2016. This technology has opportunities for significant adoption by the second quarter of 2017.

Market Opportunity

- ✓ Automotive
- ✓ Augmented reality
- ✓ Sensors
- ✓ Digital dashboards
- ✓ Aerospace
- ✓ Military and defense
- ✓ Transportation and safety

Technology Convergence

Advanced driver assistance systems (ADAS): The increasing requirement for advanced driver assistance technologies to enhance the driving experience and increase the safety of motorists is paving the way for new applications. Automakers are constantly innovating and implementing new technologies to provide interactive and user friendly interfaces for vehicle owners.

Market Entry Strategies

Carloudy is very cost efficient and offers improved battery life and efficient performance. The device can be integrated in any car and uses the Android or the iPhone as the main base for collecting information.



Heads-up Display Equipped with Amazon Alexa

HeadsUP! Inc.– HeadsUP Interactive HUD Display

Tech. Profile

The newly developed device called HeadsUP is a HUD system which is integrated with Amazon's Alexa Voice Services. It is shaped like a saucer and consists of a 6-inch display, HD speaker setup and noise cancelling microphone. The voice service works exactly like SIRI and can quickly respond to commands. Household smart devices, which are connected to the device, can also be controlled while driving the vehicle.

Competing Aspects

The device has a 6-inch (720p) heads up display with, for example, Bluetooth and Wi-Fi for connectivity. The device also consists of a camera for capturing videos, gestures, face tracking features and another 16-megapixel camera for sign detection and computer vision. By using Amazon's Alexa voice service, the user will be able to communicate with the device at ease.

Innovation Attributes

The device can be used to send texts, control music, get directions, make phone calls, and control other household smart devices. The device is also capable of car diagnosis and tracking lap timings using the G-force. All the information is augmented on the windshield of the vehicle.

Wide-scale Adoption

This can be pre-ordered in the company's website. Shipping of the product will begin during fall 2016. The technology has potential for significant adoption over the near-term.

Market Opportunity

- ✓ Automotive
- ✓ Augmented reality
- ✓ Sensors
- ✓ Digital dashboards
- ✓ Aerospace
- ✓ Military and defense
- ✓ Transportation and safety
- ✓ Sports and racing

Technology Convergence

The convergence of augmented reality technology for the development of HUD systems is anticipated to impact the automotive industry. The intensity of adoption rate of this technology convergence will likely increase in the near future. Technology convergence with other markets will also pave the way for innovation and the development of new applications which were not possible using traditional methods.

Market Entry Strategies

The company has collaborated with Amazon Inc. and has integrated the Alexa voice service in the system. This serves as a major advantage in better positioning of the product in the current HUD market. The company is also planning to add windows phone support to the device.



Analyst Perspectives

Head- Up Display (HUD) Technology in the Automotive Industry

Innovation Ecosystem Strength

Heads-up display technologies, which can present information without requiring the driver to look away from their usual viewpoint (for example, the windshield), are increasingly used in production of vehicles and have opportunities for wide-scale adoption. HUDs can also display night vision information using infrared sensors. Automakers, universities and OEMs have collaborated to research, innovate and optimize this technology for better efficiency and performance. This novel technology can also be expected to be adopted for applications in other industries such as aerospace, military and defense.

Target Markets–Near-, Medium- & Long- Term

- HUD technology is expected to impact the automotive, transportation and aerospace/defense markets in the near term. In addition to military or commercial aircraft, HUD has opportunities for use by soldiers for situational awareness.
- This novel technology will become more optimized with advanced technology features (such as enhanced gesture recognition, high-definition images) and will be easily available and adopted by the common automotive user in the medium term.
- This technology can also have opportunities to eliminate the requirement for measuring instruments such as speedometers and gauges in the automation sector, in the long-term.

Driving Forces

- By adopting HUD technology, the overall driving experience can be enhanced and the efficiency of transportation and safety of motorists and passengers improved.
- As HUD systems are voice command controlled and smart devices can be easily assessed, the requirement for motorists to use other measuring instruments for checking purposes or smart devices can be eliminated. All the required information is augmented on the windshield, thus allowing the motorist to fully concentrate on the road while driving at all times.

Entry Barriers

- At present, though there are many HUD systems in the market, an optimized concretely and very efficient system is yet to be manufactured and implemented in the automotive industry.
- The battery life and performance of the HUD systems need more improvement and the device should also be developed according to the requirements of the various global regions.
- As the implementation of this technology is expensive, and it has not thus far been implemented in vehicles in high volumes, automakers have tended to integrate these systems in high-end luxury cars. It might take some time for the automakers to reduce the price and integrate this technology in other lower variants.

Competitive Landscape



- The highest number of patents filed in relation to HUD technology in the automotive industry is from the United States and Japan followed by China and Korea.
- In relation to technology development and adoption footprint, the North American region is anticipated to foresee a high impact in the near future.
- Various research and implementations of new innovations in HUD technology have been registered in the European region. Technology development and wide-scale adoption footprint in this region is also very high.
- In the APAC region, HUD technology development intensity impact is medium, whereas the adoption rate of this technology has been very low when compared to the other regions.

Key Patents

No.	Patent No.	Publication Date	Title	Assignee
1	US20150168720	18.06.2015	Device and method for displaying head-up display (HUD) information	Hyundai Autron Co., Ltd.
	<p>Disclosed herein is a device and method for displaying head-up display (HUD) information, including: a first sensing unit for detecting a surrounding brightness around a vehicle; a second sensing unit for detecting a background brightness of a background area in which the HUD information is displayed; and a control unit for comparing the surrounding brightness with the background brightness, and adjusting a brightness of the HUD information based on the background brightness when a brightness difference between the surrounding brightness and the background brightness is equal to or more than a predetermined reference value.</p>			
2	US20150156481	04.06.2015	Heads up display (HUD) sensor system	Kenneth Varga
	<p>This application relates to a stereoscopic multi-angle camera system allowing a user to take pictures and/or video and record stereoscopic sound not only as a spherical view but also using stereoscopic imaging/recording by having two cameras, global positioning systems, magnetic sensors, environment sensors, and/or two microphones per solid angle of view such that omnidirectional visual and omnidirectional acoustic depth perception may be achieved.</p>			

Key Patents

No.	Patent No.	Publication Date	Title	Assignee
3	KR1020150094381	19.08.2015	Surrounding-based HUD control apparatus and method thereof	Hyundai Motor Company
	<p>The present invention relates to a surrounding-based HUD control apparatus and a method thereof, and is to provide a surrounding-based HUD control apparatus and a method thereof, to improve visibility and readability of various kinds of information by changing the color on a HUD screen when the color of the screen displayed by the HUD (head up display) is the same or similar to the color of an image in front of a windshield as a background color of the HUD at a spot where the sight of drivers eyes stay. The surrounding-based HUD control device comprises: an imaging unit which takes a front image as a background of a screen displayed by the HUD (head up display) through the windshield of a vehicle; a sight tracing unit which traces the sight of drivers eyes in the windshield; a control unit which detects an area where the sight of drivers eyes stays as traced by the sight tracing unit in the image taken by the imaging unit, and controls the HUD to display various kinds of information with colors different from the color of the area; and the HUD which displays various kinds of information under the control of the control unit. COPYRIGHT KIPO 2015</p>			
4	EP2899053	29.07.2015	HUD module, assembly comprising a HUD module, vehicle	Volkswagen AG
	<p>Die Erfindung betrifft ein HUD-Modul (3) für ein Fahrzeug, insbesondere Kraftfahrzeug, mit einem Gehäuse (5), das zur zumindest bereichsweisen Anordnung in einer einen Luftleitkanal (2) aufweisenden Instrumententafel (1) des Fahrzeugs ausgebildet ist. Es ist vorgesehen dass wenigstens eine Wand (7, 8) des Gehäuses (5) als Teilstück (9) des Luftleitkanals (2) ausgebildet ist.</p>			

Key Patents

No.	Patent No.	Publication Date	Title	Assignee
5	CN104527550	04.06.2015	Method and system for HUD (head up display) information interaction	Zhejiang Geely Automobile Research Institute Co., Ltd.
	<p>The invention provides a method and system for HUD (Head Up Display) information interaction, the method comprises: setting up a direct information channel between a combination meter and an HUD through an independent asynchronous serial port communication protocol; the independent asynchronous serial port communication protocol comprises a communication protocol structure, a communication timing sequence definition and an information transmission format; the combination meter obtains current vehicle running information, and directly sends the information to the HUD through the independent asynchronous serial port communication protocol; the HUD displays the current vehicle running information. The method and system can shorten the response time of display information, reduce the time delay probability, and enable a driver to cope with the change of a running condition.</p>			
6	CN104175960	03.12.2014	HUD (head up display) imaging display device for vehicles	Hong Kong Yulun International Trade Co., Ltd.
	<p>The invention relates to the technical field of vehicle information display device, in particular to an HUD (head up display) imaging display device for vehicles. The HUD imaging display device comprises a shell (7), a display screen (1) used for displaying vehicle information is arranged at the position of the inlet of the shell (7), a light source is arranged in the rear of the display screen (1), a first concave non-spherical reflector (2) is arranged in front of the display screen (1), a second concave non-spherical reflector (3) is arranged obliquely above the first concave non-spherical reflector (2), a saddle-shaped reflector (4) used for projecting vehicle information images to a vehicle windshield (8) is arranged obliquely above the second concave non-spherical reflector (3), and the first concave non-spherical reflector (2), the second concave non-spherical reflector (3) and the saddle-shaped reflector (4) are installed on the shell (7). By the arrangement, the vehicle information images can be displayed on the windshield, so that a driver need not have to bow to focus on the dashboard during driving, potential safety hazards brought by interruption of attention and switching of sight are avoided, and driving safety is improved.</p>			

Industry Interactions

Matthew Russell

Communications Manager,
BMW,
300 Chestnut Ridge Road, Woodcliff Lake,
NJ 07677
Phone: 201-307-4000
E-mail: Matthew.Russell@bmwna.com
URL: www.bmw-motorrad.com/en/

Patrick Nebout

Director Global Advanced Technologies &
Innovation,
Visteon Corporation,
1800 Route des Crêtes, France
Phone: +33-4-92-95-26-00
E-mail: npatrick@visteon.com
URL: www.visteon.com/

Beth Miller

Public Relations Officer,
HeadsUP! Inc.,
517 Rampart Way; Oxon Hill, MD 20745
E-mail: beth.miller@getheadsup.com
URL: www.getheadsup.com

Javy Kong

Co-founder,
Cognitive AI Technologies Inc.,
Chicago, IL
E-mail: javykong@carloudy.com
URL: www.carloudy.com/