



PETER KOVÁČIK

Display Device of Information to Car Driver

Doc. Ing., PhD., Vysoká škola DTI in Dubnica nad Váhom, Slovakia

Abstract

The article deals with possibilities of information imaging to car driver. It mentions to development and exploitation of electronics to display complex and well-arranged information that is necessary at intensive traffic. The topic is completed by amount of graphical material that is needed for demonstrative visualization to reader in compliance with principles of attractiveness and visual demonstration used at dual education as progressive method at present time.

Keywords: automobile, visual information, Instrument Cluster Display, Head up Display (HUD)

Introduction

At present, a quantity of executed information markedly increase at each field of human activity. It is as well at automobile, where increasing number of physical values is measured that relate with particular systems of traction, gear, navigation, etc. A part of measured values is processed directly and car driver never knows it, but lot of information car driver has to receive which allow him to control automobile by adequate way. Even though experimental drive of cars controlled autonomously without intervention of car driver is beginning, car will be controlled by car driver using displayed information many years yet.

Electronic sensors of a car that increase quality of car driving and control

A man receives approximately 85% of information visually. This is reason why greater part of measured parameters is displayed at dashboard to driver:

- Two state information is the simplest and represent mostly indicators that display activation or deactivation of device or system (for example low pressure of oil).
- Analogue – a device with mechanical or electromechanical mechanism with rotating coil or magnet that display information by analogue technique by needle.
- Digital – it displays information only in digital shape.
- Combined – it includes simultaneously analogue and digital style of visual imaging of information. Combined dashboard indicators are mostly used at present time and form instrument cluster of dashboard.

- Video – for example output of parking car camera systems and systems of night vision.

Combined dashboard indicators (analogue and combined) usually have technical problems: most frequently there is failure of little tooth-wheel of mechanisms, little engines and electromechanical parts. Corrections of such dashboards are technically demanding and usually there is need to exchange whole dashboard or its substance, because dashboard consists of compact and fixation units.

At present, electric (electronic) transfer of information is used mostly, that is realized by analogue or digital signals. Non electric values measurement is realized by a converter that transforms non electric value to electric analogue value that is processed in analogue digital converter and transferred into required devices. Electric transfer of information has advantage: it can be realised to long distance, a precision of transferred information is higher, transferred information can be used by control units of more devices.

Digital signal transfer using and expressive progress at display technology (bigger viewing angle, bigger brightness and contrast, colour saturation, etc.) including massive decrease in prices caused that imaging by displays become available in cars. All knowledge acquired from application of imaging by displays at aviation (Fig. 1, 2) is used of course.



Fig. 1. Aeroplane cockpit with classical indicators

(<https://pbs.twimg.com/media/CnLuUBIWAAA-1X8.jpg>)

Advantages of imaging by display led, at first phase, to use it as Multi Information Display with low dimension that was situated directly into dashboard, usually between tachometer and engine speed-indicator. Multi Information Display was monochromatic at first, it is colour with shape of square, rectangle or

with specific shape (its resolution increases gradually) at present. Multi Information Display allows to present more information from on-board computer at the same time. Colour display is able to substitute some indicators and utilize area of dashboard better.



Fig. 2. Aeroplane cockpit with displays (glass cockpit)

(https://upload.wikimedia.org/wikipedia/commons/a/a4/Airbus_A380_cockpit.jpg)

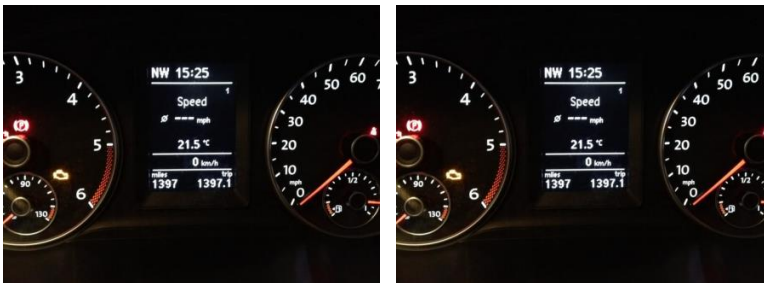


Fig. 3. Examples of display situated between classical indicators of car

(<https://vwcaliforniaclub.com/threads/changing-the-speed-display-on-vw-t5-california-dash-insert.1536/>; https://www.google.sk/search?q=vw+display&client=firefox-b&tbm=isch&imgil=IDv8ZRggBRN0bM%253A%253Bi8zaszc68n6VOM%253Bhttps%25253A%25252F%25252Fwww.youtube.com%25252Fwatch%25253Fv%2525253DAxH3DBzm9A8&source=iu&pf=m&fir=IDv8ZRggBRN0bM%253A%252Ci8zaszc68n6VOM%252C_&usg=__hRcra7FG6cMP-bFjVCsR52W0iKk%3D&biw=1920&bih=969&ved=0ahUKEwio34XXz5vTAhUBPRQKHMYM9AkoQyjcIKA&ei=FWPsWOiACYH6UIP7iNAE#imgdii=m2lwVaSjmbvXJM:&imgcr=k91saSgx2NUOUM)

A term viewing field relates closely with task of information imaging. It consists of area:

- Strict visual perception – a man see sharply and all colours
- Peripheral visual perception – good perception of movement with smaller details and colour distinction.

This is reason why displays of information should be situated on dashboard at centre of viewing field of car driver. It assures that driver do not has to move his look from territory in front of car for unreasonable long time. There is need to optimize: symbol size, size and shape of characters, etc.

Classical dashboards have essential insufficiency based on limited surface for presentation of additional information and additional indicators. The only solution of this insufficiency is multiple using of dashboard surface by electronically controlled displays that are able to image lot of information on one place in sequence. A dashboard in the form of display is able to combine all instruments into one imaging unit, including navigation system, multimedia system directly within viewing field of car driver.

Instrument Cluster Display

Instrument Cluster Display represents future of information imaging to car driver. That dashboard consists only from displays that offer large area to information imaging and do not contain any movable parts. The biggest advantage of that dashboard is its universality, because amount of information and their graphical representation give to constructors and designers almost unlimited possibilities. This enables to visualize, at viewing field of car driver, all necessary information including map support of navigation system without dashboard area enlarging.



Fig. 4. Examples of the same Instrument Cluster Display at different situations

(<http://www.audi.co.za/za/brand/en/vorsprung-durch-technik/content/2014/03/audi-virtual-cockpit.html>)

Fig. 4 symbolizes situation: when car driver is approaching towards blind crossroad, he can change representation of map onto whole area of display (instrument indicators change to smaller dimension). Car driver has perfect overview about situation and does not have to turn view from viewing field into centre of car board where display of navigation system is usually situated.



Fig. 5. Instrument Cluster Display of other car type

(http://galeria.vezess.hu/files/995/078/000/78995/78995_652531_784x523.jpg)

Head up Display

Head up Display (HUD) is technology of information imaging passed into automobiles from aeroplanes moreover, shown in Fig. 6.



Fig. 6. Composite information displayed by HUD in aeroplane

(<http://airchive.com/blog/wp-content/uploads/2013/08/BOEING-MIAMI-787-SIM-INT-8-HUD.jpg>)

A principle of HUD technology is based on back projection of chosen data from dashboard onto screen of car or polycarbonate (glass) plate situated directly into driver's view. Resulting virtual picture acts as it was in front of a car. Car driver does not have to move attention between situation on roadway and dashboard, neither to regrid eyesight to different distances. Two basic constructions of HUD are used at automobiles:

- A projection of information on screen of car – this solution requires that the screen has to be supplemented by thin foil inserted between segments of car screen. Presented data are projected on foil of car screen by system of mirrors (Fig. 7).

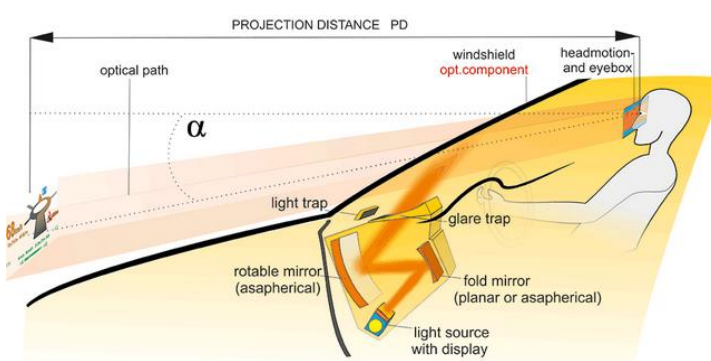


Fig. 7. Principle of HUD with projection of data on car screen

(<http://turbozens.com/continentalsheadupdisplay-hud/>)



Fig. 8. The example of data projection on car screen

(<https://www.audiworld.com/forums/attachments/a7-192/18805d1312246897-head-up-display-bmw-new-full-colour-hud-29926.jpg>)

A disadvantage of this solution is high price of special car screen. Special car screen can be replaced by standard car screen, but at the place of projection has to be stick special foil.

- Projection of information to polycarbonate or glass plate with special foil, situated in car driver viewing field that serves as optical combination.

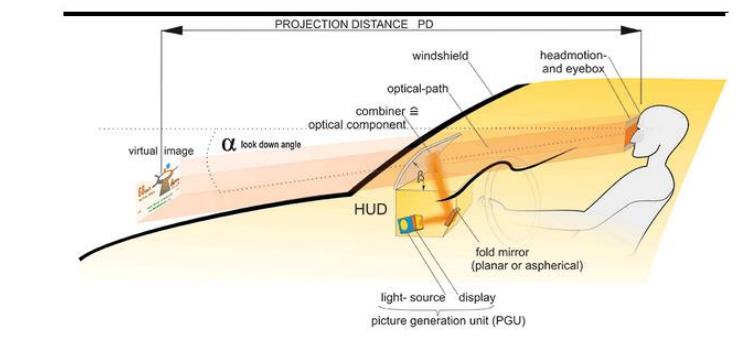


Fig. 9. Principle of HUD with data projection on optical combination plate in automobile
(<http://turbozens.com/continentalsheadupdisplay-hud/>)

There are two constructive solutions: tipping, slide-out. When HUD is activated it is throw out, after deactivation it is settle into dashboard.



Fig. 10. Example of HUD with data projection on optical combination plate in automobile

(<http://www.automotiveworld.com/wp-content/uploads/2014/06/Bosch-head-up-display.jpg>;
https://www.google.sk/search?q=vw+display&client=firefox-b&tbm=isch&imgil=F2ZJM2yh9WbGkM%253A%253BzF1f2cuHBShcDM%253Bhttp%25253A%25252F%25252Fwww.cars-equipment.com%25252Fwww%25252Fen%25252Fshop%25252Fdisplays-5%25252Foem-92-290-206-instrument-clusters%25252F&source=iu&pf=m&fir=F2ZJM2yh9WbGkM%253A%252CzF1f2cuHBShcDM%252C_&usg=__YAUNKfKCRNiCkpWshEQXztiGuto%3D&biw=1920&bih=969&ved=0ahUKEwio34XXz5vTAhUBPRQKH9AkoQjycIKA&ei=FWPsWOiACyH6UIP7iNAE#imgrc=YC9r17NETDf1fM)

HUD images only several fundamental information (max. 4–5), not to disturb an attention of car driver by lot of information.



Fig. 11. HUD additionally installed into automobile

(<https://www.aliexpress.com/item/Auto-5-5-HUD-Head-Up-Display-Windscreen-Projector-OBD-II-Car-Data-Diagnosis-VW-Golf/32731790737.html>)

HUD technology is become accessible to standard car driver by imaging device that projects basic data on car screen that is shown in Fig. 11.

Conclusion

The aim of the article is brief survey of development of information display devices for car driver. The article tries to attract an interest of young generation by its content and form, and bring young people to study technical knowledge. The development of mentioned technologies is applicable at large proportion at whole society. This is a reason, why this knowledge has cardinal importance.

Literature

- <http://airchive.com/blog/wp-content/uploads/2013/08/BOEING-MIAMI-787-SIM-INT-8-HUD.jpg> (20.04.2017).
- http://galeria.vezess.hu/files/995/078/000/78995/78995_652531_784x523.jpg (20.04.2017).
- <http://turbozens.com/continentalsheadupdisplay-hud/> (20.04.2017).
- <http://turbozens.com/continentalsheadupdisplay-hud/> (20.04.2017).
- <http://www.audi.co.za/za/brand/en/vorsprung-durch-technik/content/2014/03/audi-virtual-cockpit.html> (20.04.2017).
- <http://www.automotiveworld.com/wp-content/uploads/2014/06/Bosch-head-up-display.jpg> (20.04.2017).
- <https://pbs.twimg.com/media/CnLuUBIWAAA-1X8.jpg> (20.04.2017).
- https://upload.wikimedia.org/wikipedia/commons/a/a4/Airbus_A380_cockpit.jpg (20.04.2017).
- <https://vwcaliforniaclub.com/threads/changing-the-speed-display-on-vw-t5-california-dash-insert.1536/> (20.04.2017).
- <https://www.aliexpress.com/item/Auto-5-5-HUD-Head-Up-Display-Windscreen-Projector-OBD-II-Car-Data-Diagnosis-VW-Golf/32731790737.html> (20.04.2017).
- <https://www.audiworld.com/forums/attachments/a7-192/18805d1312246897-head-up-display-bmw-new-full-colour-hud-29926.jpg> (20.04.2017).

https://www.google.sk/search?q=vw+display&client=firefox-b&tbm=isch&imgil=IDv8ZRggBRN0bM%253A%253Bi8zaszc68n6VOM%253Bhttps%25253A%25252F%25252Fwww.youtube.com%25252Fwatch%25253Fv%2525253DaxH3DBzm9A8&source=iu&pf=m&fir=IDv8ZRggBRN0bM%253A%252Ci8zaszc68n6VOM%252C_&usg=__hRcra7FG6cMP-bFjVCsR52W0iKk%3D&biw=1920&bih=969&ved=0ahUKEwio34XXz5vTAhUBPRQKH YM9AkoQyjclKA&ei=FWPsWOiACYH6UIP7iNAE#imgdii=m2lwVaSjmbvXJM:&imgcr=k91saSgx2NUOUM (20.04.2017).

https://www.google.sk/search?q=vw+display&client=firefox-b&tbm=isch&imgil=F2ZJM2yh9WbGkM%253A%253BzF1f2cuhBShcDM%253Bhttp%25253A%25252F%25252Fwww.cars-equipment.com%25252Fwww%25252Fen%25252Fshop%25252Fdisplays-5%25252Foem-92-290-206-instrument-clusters%25252F&source=iu&pf=m&fir=F2ZJM2yh9WbGkM%253A%252CzF1f2cuhBShcDM%252C_&usg=__YAUNKfKCRNiCkpWshEQXztiGuto%3D&biw=1920&bih=969&ved=0ahUKEwio34XXz5vTAhUBPRQKH YM9AkoQyjclKA&ei=FWPsWOiACYH6UIP7iNAE#imgcr=YC9rI7NETDf1fM (20.04.2017).