BRAIN DRIVE

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Abstract - *According to different sources, speeding causes almost 67% of road accidents in India. There are other reasons for mishaps on Indian roads / human errors, potholes and manufacturing defects in vehicle, but speeding is a problem on an entirely different level. Most speeding cases are the result of negligence with the driver unable to break in time. Autonomous Driving (AD), the advent of smart cars is expected to fix this. Brain Drive is an autonomous vehicle that integrates the concept of BRAIN COMPUTER INTERFACE (BCI) within it to make driving more reliable and advanced. Brain Drive is the technology that reads driver's brain in real time and execute driving tasks accordingly. We can also say that BRAIN DRIVE can be evolution of an autonomous vehicles but it is also important to note that this is still in developmental and evolving phase.*

Key Words: **Autonomous Driving, Brain Computer Interface (BCI), Computing Brain, Self Driving Car, Electroencephalogram (EEG), Global Positioning System (GPS), RADAR, LIDAR**

1. SENSOR :

For safer, reliable and easier drive of an autonomous vehicle different types of sensors are used. Each type of sensor is allotted different types of operations to be executed. According to different driving operations, we classified sensors as below from where, here are seven sensors mainly used in autonomous vehicles.

- Antenna (GPS)
- Radio Detection & Ranging (RADAR)
- Light Detection & Ranging (LIDAR)
- Wheel Odometer Sensor
- Ultrasonic Sensor (SONAR)
- Video Camera

1.1 Antennas (GPS):

Antennas senses an electromagnetic field and convert it to an electrical signal. There are many antennas in a typical automobile including antennas for AM and FM radio reception, GPS navigation, Bluetooth communications and many more. Antennas are also an integral part of radar distance sensors. Accuracy of the antennas highly depends on the actual positioning methods and the corrections used.

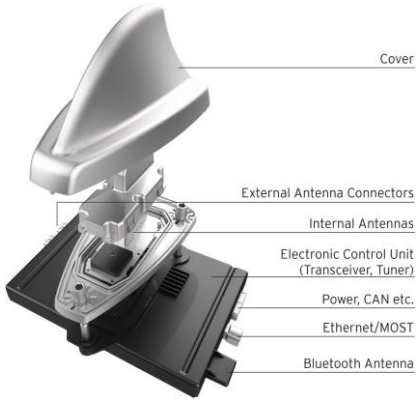

Fig -1.1: ANTENNA

1.2 Radio Detection and Ranging (RADAR):

Some cars and trucks are equipped with headway sensors that detect the distance between vehicles or large objects in front of the vehicle. These sensors are used by adaptive cruise control and/or collision avoidance systems. Most existing headway sensors use a *76.5 GHz radar*, but other frequencies (e.g. 24 GHz, 35 GHz and 79 GHz) are also in use. Some systems use infrared sensors instead of (or in addition to) the RADAR sensors. RADAR signals are very good at detecting objects that strongly reflects electro-magnetic radiations (e.g. metal objects) because they operate at wavelengths on the order of a few mili-meters, automotive RADAR systems are pretty good at detecting objects that are several centimetres or larger. It is also used in *collision avoidance* system, *blind spot detection* system and *automated parking* system.

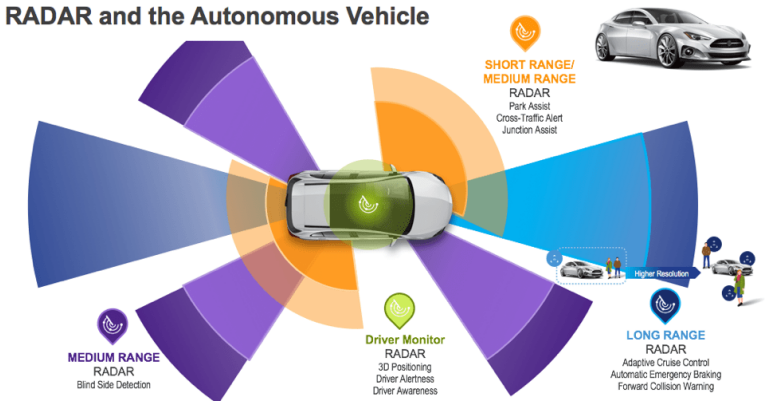

Fig -1.2: RADAR

1.3 Light Detection and Ranging (LIDAR):

LIDAR (For Light Detection and Ranging) sensors work by *transmitting pulse of light* (usually infrared) & waiting for the *reflected signals*. They can detect objects with much greater resolution than RADAR or acoustic sensors due to small wave length employed. It involves shooting light beams into environment and measuring the reflected beam. By measuring amount of returned light and time of the beam both in intensity & range to the reflecting object can be estimated. LIDAR are not affected by the environmental conditions (Lightning etc.). It creates *detailed 3D scene geometry* of surroundings.

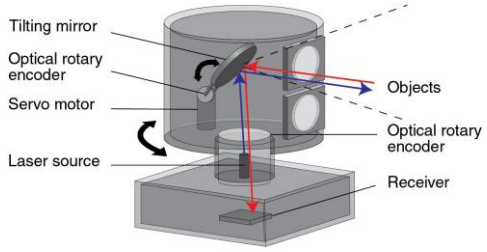

Fig -1.3: LIDAR

1.4 Wheel Odometer Sensor :

Odometry is the use of data from motion sensors to estimate change in position over time. This sensor tracks wheel rotation, velocity & orientation of autonomous vehicle. WOS uses speed accuracy and position drift to calculate overall speed and orientation of vehicle.

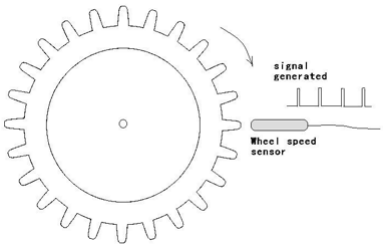

Fig -1.4: ODOMETER SENSOR

1.5 Ultrasonic Sensor (SONAR):

Ultrasonic Sensors / SONAR measures range using ultrasonic sound waves. Ultrasonic waves are short range, so they are good for close operations like parking scenarios where vehicle needs to make movement very close to each other. Like LIDAR, they are also not affected by environmental conditions (Lightning etc.). They are not so expensive like LIDAR.

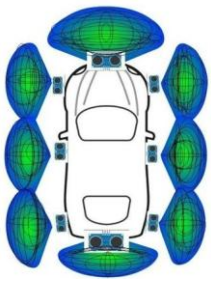

Fig -1.5: SONAR

1.6 Video Camera:

They are exteroceptive type of sensor. They enables depth estimation from image data. The combination of two cameras

With over lapping field of view and align image plane is called is called Stereo Camera. Stereo cameras allows depth estimation from synchronized image pair.

Fig -1.6: VIDEO CAMERA

2. CENTERAL PROCESSING UNIT (CPU):

It's the main decision making unit of the autonomous vehicle. It is also known as the *self-driving brain* of autonomous vehicle. It computes all the actions to be executed. There are already existing advance systems that can do self-driving vehicle processing i.e. NVIDIA DRIVE PX / AGX, INTEL & MOBILE EYEQ. It considers image processing, object detection, smart decision, mapping and manymore.

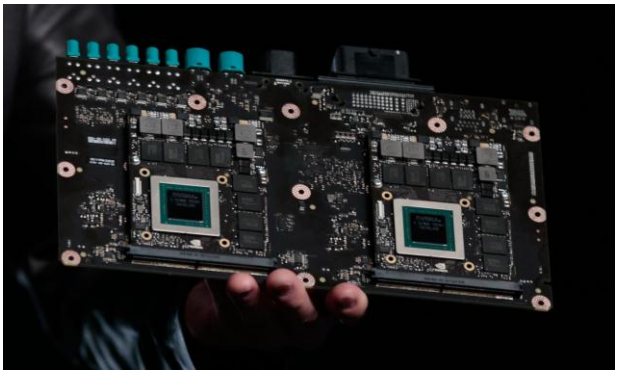

Fig -2: CPU

3. BRAIN COMPUTER INTERFACE (BCI):

Brain Computer Interface is an emerging & growing field which is an extraordinary way to interact with your device directly from brain. According to wikipedia, a brain-computer interface (BCI), sometimes called a neural-control interface (NCI), mind-machine interface (MMI), direct neural interface (DNI), or brain-machine interface (BMI), is a direct Communication pathway between an enhanced or wired brain and an external device. This main sensor / device used for sensing Electroencephalogram (EEG).

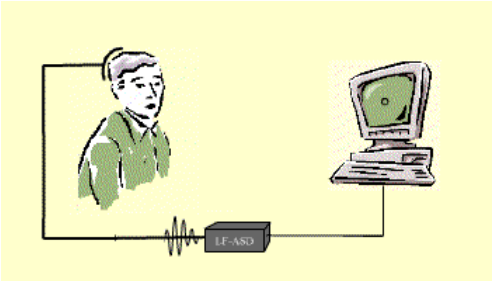

Fig - 3: BCI

3.1 Electroencephalogram (EEG):

- The main use of EEG is to catch the wave patterns of the brain.
- EEG amplifies those signals.
- Amplified signals will send to machine / computer by EEG device.

Fig -3.1: Electroencephalogram (EEG)

4. OUR CONCEPT:

This image shows the basic orientation of the sensors in BRAIN DRIVE. It also includes general overview of the costing. All these objects are integrated with BCI system and this is the actual concept of BRAIN DRIVE. Concept of the BRAIN DRIVE (ALGORITHM) how it works:

- Order is given by brain to EEG.
- EEG amplifies these signals.

- Signals is received by machine / computer with the help of Bluetooth module which will send by EEG.
- Signals are converted into machine understandableform.
- Order is executed by car.

EXPLAINATION:

Firstly, the driver has to wear EEG headset to start the process. The brain will generate signals according to control the vehicle. EEG scans are performed by placing EEG sensors– small metal discs also called EEG electrodes – on your scalp. These electrodes pick up and record the electrical activity in your brain. The collected EEG signals are amplified, digitized and then sent to the computer for storage and data processing. These signals will received by CPU having bluetooth module. Then after these signal will be processed (Converting to machine under-stable language and will be go ahed for execution of operations) and the final order will executed.

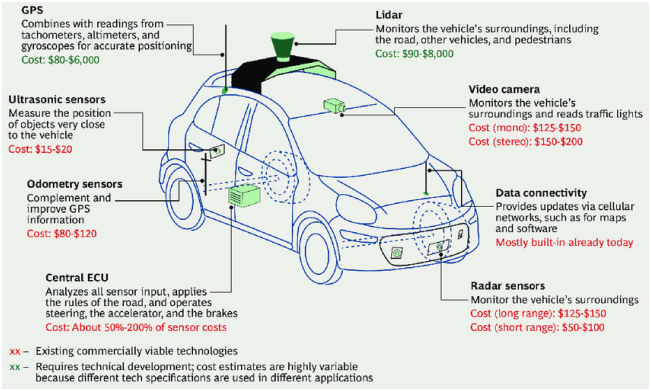

Fig -4: SENSOR ORIENTATION

5. ADVANTAGES / DISADVANTAGES:

5.1 Advantages:

- Futuristic Technology
- Evolution in the era of autonomous industry
- Specially designed for old age / handicap people
- Easy changing modes from auto to manual and vice versa

5.2 Disadvantages :

- Costlier
- Complex to understand the system.
- Can't change mode during drive

6. CONCLUSION:

Since, this technology is not that much popular, it is continuously developing field. This technology will take autonomous technology on another level. This vehicle is the future of the autonomous industry and will play huge role in industry 4.0.

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BIOGRAPHIES

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