

1. Sensors that are used to obtain data for autonomous vehicle navigation are:

- **Cameras:**

Cameras work on the basic principle of landing the light emitted from the objects on a photosensitive surface through a lens. The photosensitive surface also called the image plane is where the light is stored as an image.

**Uses:**

Autonomous vehicles can visualize their environments with high-resolution digital camera images to interpret environmental details such as signs, traffic lights, and animals to approximate human vision.

**Advantages:**

Cameras are very good at detecting and recognizing objects, so the image data from cameras can be passed to AI-based algorithms for object classification. They are relatively cheap compared to Radar and Lidar.

**Disadvantages:**

Visible light cameras have limited capabilities in conditions of low visibility. Additionally, using multiple cameras generates many video data streams to process, which requires powerful computing hardware.

- **Radar:**

Autonomous cars can emit radio waves in general directions with radar transmitters. Reflected waves that return to a car's radar receiver help the car derive information about environmental objects like the objects' angles, ranges, and velocities.

**Uses:**

Radar facilitates active driver assistance such as Blind Spot Detection, lane-change assistance, Rear-end collision warning or collision avoidance, Park Assist, Cross-traffic monitoring, Emergency braking and Cruise control.

**Advantages:**

Radar works best at detecting objects made of metal. Radar typically operates well over long distances and in most weather types.

### **Disadvantages:**

Radar is not handy for object identification and may falsely identify objects. Usage of a Shorter wavelength does not allow the detection of small objects. RADAR cannot provide the user with a precise image of an object because of the longer wavelength.

- **LIDAR:**

LiDAR emits laser beams at eye-safe levels. The beams hit objects in the environment and bounce back to a photodetector. The beams returned are brought together as a point cloud, creating a three-dimensional image of the environment.

### **Uses:**

LiDAR's central premise is to act as a vehicle's eyes to always see in all directions. With a real-time ability to map the world in 360 degrees, LiDAR helps vehicles identify objects on or near the roadway to avoid collisions with pedestrians, cyclists, animals, and other vehicles, stationary or moving.

### **Advantages:**

Lidar systems enable self-driving cars to detect small objects with high precision.

### **Disadvantages:**

LIDAR is very expensive and is often unreliable at nighttime or in inclement weather.

**Sensor Fusion:**

Sensor fusion is the process of combining sensor data or data derived from disparate sources such that the resulting information has less uncertainty than would be possible when these sources were used individually.