The term “odometry” originated from the two Greek words *hodos* (meaning “journey” or “travel”) and *metron* (meaning “measure”).This derivation is related to the estimation of the change in a robot’s pose (translation and orientation) over time. Mobile robots use data from motion sensors to estimate their position relative to their initial location; this process is called odometry.

Accurate localization of a vehicle is a fundamental challenge in mobile robot applications. A robot must maintain knowledge of its position over time to achieve autonomous navigation. Therefore, various sensors, techniques, and systems for mobile robot positioning, such as wheel odometry, laser/ultrasonic odometry, global position system (GPS), global navigation satellite system (GNSS), inertial navigation system (INS), and visual odometry (VO), have been developed by researchers and engineers.

However, each technique has its own weaknesses. Although wheel odometry is the simplest technique available for position estimation, it suffers from position **drift due to wheel slippage**

INS is **highly prone to accumulating drif**t, and a highly precise INS is expensive and an unviable solution for commercial purposes. (**It is still highly recommended that you accommodate an IMU in your robot)**

Although GPS is the most common solution to localization as it can provide absolute position without error accumulation, it is **only effective in places with a clear view of the sky**. Moreover, it cannot be used indoors and in confined spaces . The commercial GPS estimates position with errors in the order of meters. This error is considered too large for precise applications that require accuracy in centimeters, such as autonomous parking. Differential GPS and **real time kinematic GPS can provide position with centimeter accuracy, but these techniques are expensive.**

You have already learned about particle filters and SLAM in your previous learning materials (DS and A). Can you name some limitations of Lidars or

similar sensors? (If you cant, you should search Elon musk and lidar, you will surely get some **colorful** results).

Which leaves us with **Visual odometry**. This is an area of very active research and is evolving as we speak. However, some drawbacks of this include **bad performance in low lighting**, the possibility of mismeasurement caused by sudden flashes of light, absence of depth measurements or camera calibration parameters, a **large amount of processing power required** for real-time results, etc.

There are multiple advances in camera technology in order to capture the missing depth dimension. Two of which you can use are :

Depth Cameras. These use lasers to identify and overlay depth data along with the RGB data they output.

Stereo cameras These are systems of multiple RGB cameras rigged in a manner similar to our eyes, In order to perceive some depth information.