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**Technology Overview - ARCore vs RTAB-Map**

1. **Introduction -** The following document was written for the purpose of promoting and developing research in the field of autonomous vehicles, in the document we will make a comparison between **ARCore** - platform for building augmented reality experiences by Google and **RTAB-Map** - RGB-D, Stereo and Lidar Graph-Based SLAM approach closure detector.
2. **Goal -** Familiarity with the platforms and the technology behind them, advantages and disadvantages of each of the platforms, knowledge of the hardware required to use the platforms correctly and classification of use of the platforms as needed.
3. **ARCore (**[**Augmented Reality**](https://www.geeksforgeeks.org/virtual-reality-vs-augmented-reality-whats-the-difference/) **Core) –**

ARCore uses three key capabilities to integrate virtual content with the real world as seen through your phone's camera:

* **Motion Tracking:**When you use an AR-based application, you are asked first to open your camera and sometimes also asked to move your phone. This is done to capture your surrounding and detect distinct features from it also called **feature points.**ARCore uses SLAM (Simultaneous Localization And Mapping) to understand the position of your phone relative to your surrounding. Once the feature points are detected, SLAM uses them to compute the change in location. To compute the position and orientation of the phone relative to its surrounding, over time, the visual information detected by the camera is combined with the measurements of the IMU (Inertial Measurement Unit: an electronic device that measures and reports a body’s specific force, angular rate, and sometimes the orientation of the body, using a combination of accelerometers, gyroscopes, and sometimes magnetometers).
  + **Environmental Understanding:** As we already discussed the feature points, ARCore looks for clusters of these feature points that lie on the same horizontal or vertical surfaces like a table or a door and makes this information available to your app. Later, this information is used to place 3D objects on flat surfaces.
  + **Light Estimation:**To make virtual content more realistic, it is always a good choice to consider light as one of the significant areas to work on. As the light gets reflected in different directions after falling onto an object making the environment pleasing to the eyes of a viewer, the concept of light estimation tries to do the same with the 3D objects. After capturing images of the surrounding, ARCore provides information about the average intensity and color correction of the images which lets a developer light a virtual object under the same conditions as the surrounding environment.

Accesibility - ARCore is designed to work on a wide variety of qualified Android phones running Android 7.0 and later.

Essentially, ARCore is doing two things: tracking the position of the mobile device as it moves, and building its own understanding of the real world.

1. **RTAB-Map –**

The main function of RTAB-Map is RGB-D or LiDAR-based SLAM (Simultaneous Localisation and Mapping), but since it generates a 3D representation of the environment, it can also be used for 3D reconstruction. It is a three-dimensional, graph-based approach that detects occurrences when an image comes from a previously seen location. When a loop closure is detected, a constraint is added to the graph and the error is minimised. To capture RGB-D data, an Intel RealSenseTM Depth Camera was used. The camera works similarly to a Microsoft Kinect: it has a point matrix projector, two infrared cameras, and an RGB camera. The calculation of the depth information is performed onboard the camera, and through a wrapper it provides ROS with RGB-D data. The RTAB-Map package implements odometry and mapping and provides a visualisation tool with which the resulting point clouds can be exported in their raw or processed form into meshes. Running RTAB-Map for SLAM in ROS environment can export the captured point cloud to PCD format. The RealSenseTM camera, which belongs to the category of active stereoscopy, is equipped with a built in IMU. Combined with RTAB-MAP for SLAM, it is possible to achieve mapping and localisation. The built-in IMU can only provide reliable pose data for a short time due to a runtime-related drift error in the sensors. Therefore, moving the device too fast or too suddenly can interrupt the recording process and result in a faulty point cloud.

1. **RTAB-Map vs. ARcore –**

In comparison we will focus on the structure and use of the camera.In image analysis and processing there is great controversy as to which camera is better for us to use. A standard camera analyzes two X and Y axes, so in the resulting image you can only analyze with the help of these axes. In contrast, an Intel camera has a Z axis, the depth axis.

For example: when we want to understand whether a certain object in space is approaching us, then in the normal camera we will focus on the object itself - whether its width is increasing so we are approaching it.

On the other hand, in the second version we have the Z axis that will constitute our distance and according to it we can know if we are getting closer.

ARcore is based on a standard camera found in almost every phone.

RTAB-Map is based on an intel real sense camera which has three axes.

The differences are not great and both come to more or less the same results.

But the advantages of ARcore are in surfaces, the software knows how to identify surfaces better (even if there is a table on the floor he knows how to separate the two and mark them in different colors).

On the other hand, the advantage of RTAB-Map is when it comes to distance - the camera knows how to identify distant objects better and knows how to give a more accurate elevation map.