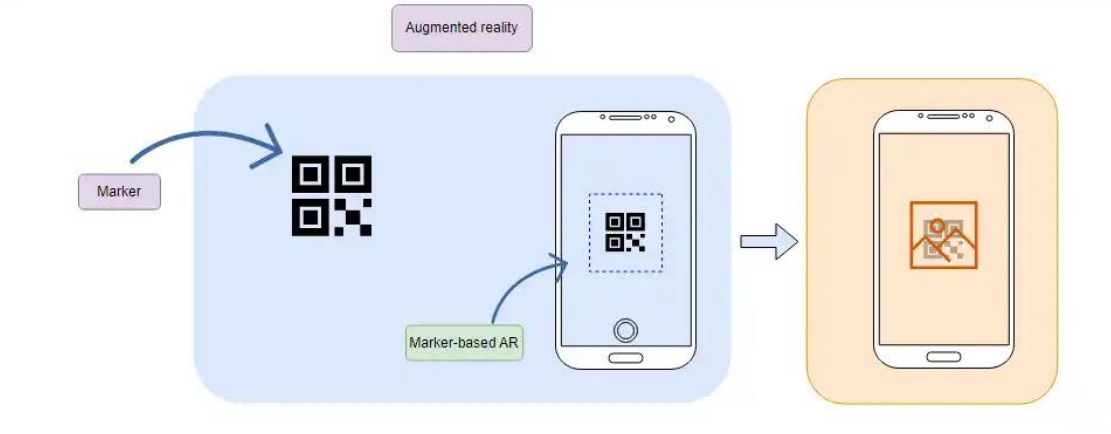
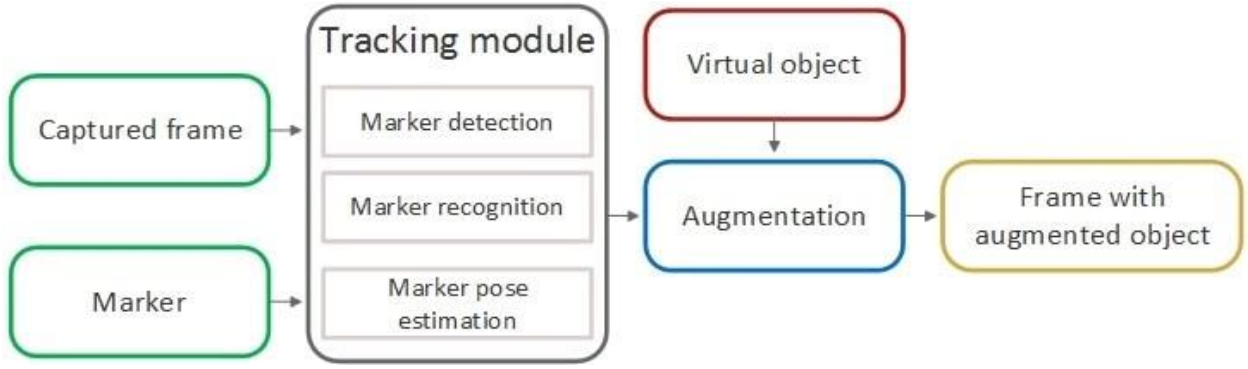
Introduction to marker-based tracking

Marker-based AR is a specific approach where real-world objects, known as markers or triggers, act as a reference point for AR content to be superimposed. These markers are recognized by AR systems, which then overlay digital content onto the markers. Essentially, these markers serve as a bridge between the physical and digital worlds.



The main objectives of AR are the analysis of changes in the captured camera frames and the correct alignment of the virtual data into the camera scene based on the tracking results. In turn, a marker-based approach provides accurate tracking using visual markers, for instance, binary markers (designed by ARUCO, METAIO, etc.) or photos of real planar objects in a camera scene.



AR system flowchart

At first, we need to have the marker image and extract the consecutive camera frames. The tracking module in flowchart is the core of the augmented reality system. It calculates the relative pose of the camera based on correctly detected and recognized marker in the scene. The term “pose” means the six degrees of freedom (DOF) position, i.e. the 3D location and 3D orientation of an object. The tracking module enables the system to add virtual components as a part of the real scene. And since we’re dealing with camera frames in 2D coordinates system, it is necessary to use the projective geometry for virtual 3D object augmentation.

Pros

- If the marker image is prepared correctly, marker-based AR content provides quality experiences and tracking is very stable, the AR content doesn't shake
- Easy to use, detailed instructions are not required for people who use it for the first time

Cons

- When the mobile camera is moved away from the marker, AR experience disappears and the trigger photo has to be scanned again. It is possible to use extended tracking, but in most cases, extended tracking makes things worse.
- Scanning will not work if markers reflect light in certain situations (can be challenging with large format OD banners in ever-changing weather conditions)
- Marker has to have strong borders/contrast between black and white colors to make tracking more stable. Smooth color transition will make recognition impossible.