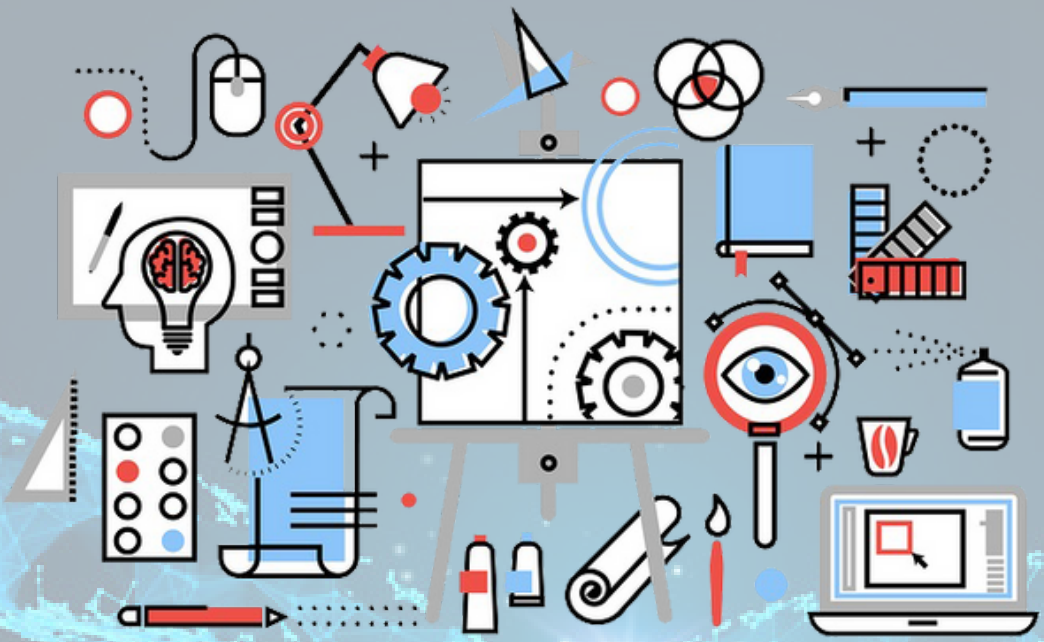
XRIG - IITM



AR TUTORIAL#5

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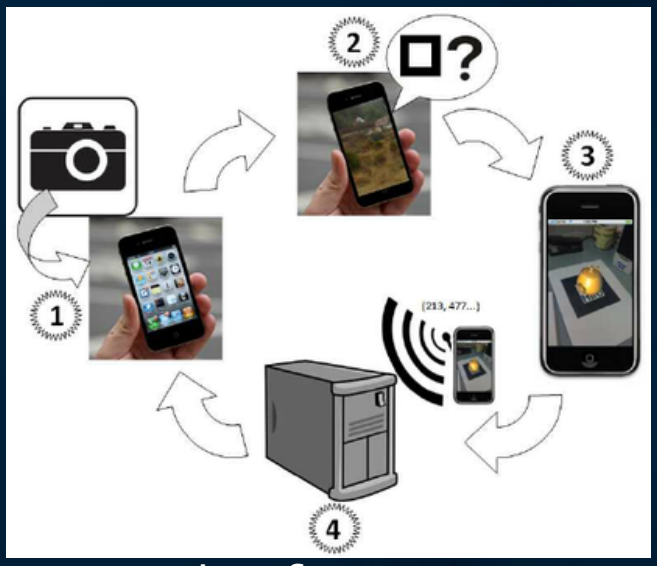
Marker Detection Process

Marker detection is a fundamental technique used in AR to accurately track and anchor virtual objects onto physical surfaces, such as printed markers or objects with unique visual features. In this tutorial,we will going to see how marker detection in AR works.



Capture Image: The first step in AR is capturing an image frame using a camera. The camera can be on a device such as a smartphone, tablet, or any other AR-enabled device.

Preprocessing: Once the image is captured, it undergoes preprocessing to enhance the quality and improve marker detection accuracy. Several techniques can be employed in this step:

a. Grayscale Conversion: The captured image is converted to grayscale.
b. Noise Reduction: To remove any unwanted noise or artifacts from the image, filters like Gaussian blur or median filtering can be applied.
c. Image Thresholding: Thresholding converts the grayscale image into a binary image

Marker Localization: In this step, a marker detection algorithm is applied to the preprocessed frame to identify markers. The marker detection algorithm analyzes the image's pixel intensity and pattern arrangement to identify specific marker patterns. Standard marker detection algorithms include techniques such as template matching, feature-based methods (e.g., SIFT, SURF), or machine learning-based approaches (e.g., Haar cascades, convolutional neural networks). These algorithms search for patterns that match the predefined marker templates or features.

Marker Identification :The marker identification process can involve decoding a binary pattern encoded within the marker or using predefined marker templates with known IDs. By matching the detected patterns or IDs with the predefined ones.

Pose Estimation: Pose estimation determines the position and orientation (pose) of the detected markers in the camera's field of view. One commonly used technique for pose estimation is tomography. Homography is a transformation that maps points from one plane (marker's coordinate system) to another plane (camera's coordinate system). It captures the geometric relationship between the marker and the camera. The homography matrix enables the transformation of points in the marker's coordinate system to regard the camera's coordinate system. A homography matrix is computed using algorithms such as Direct Linear Transform (DLT) or RANSAC (Random Sample Consensus).

Rendering AR Content: Using the marker's pose obtained from the homography matrix, virtual content is generated and overlaid onto the marker's position in the camera fed.