Augmented Reality system and functionality

- *Augmented reality* systems superimpose **computer graphics** imagery on the real world.

- This enables data to be visualized *in **situ**,* so that, for example, **medical data visualizations appear at the appropriate place** in a living person. ***Situ- Meaning in place or in position***

- For this blending of **real and virtual imagery** to be achieved, the viewpoint of the observer must be accurately known and the objects' positions and shapes in the local environment must also be stored in the controlling computer.

Difference between AR and VR

AUGMENTED REALITY VS VIRTUAL REALITY	
Augmented reality (AR)	**Virtual reality (VR)**
AR is a combination of real and virtual worlds	VR creates entire virtual world
It lets people interact with both real and virtual worlds and distinguish between the two	It's hard to differentiate between what is real and what is not
Generally, it is experienced by using a smart-phone, laptop or tablet	This is experienced by wearing VR headsets (mounted or handheld-controlled)
The purpose of AR is to enhance experience by adding virtual components such as digital images and graphics as a new layer of interaction with the real world	The purpose of VR is to create its own reality that is completely computer-generated
Users remain in the real world	Users are transported into a new world
It adds relevant information to the existing real-world view	It incorporates heavy graphics to create a virtual environment
It is mostly used for demonstrations, interior designing and mapping	It is used in games, medicine, military, etc
Users maintain a sense of presence in the real world	Senses of users are under the control of the system
Users can move, rotate, scale and manipulate 3D objects in real world	Users can move, rotate and scale 3D objects in virtual world
Users are present at the location of experience	Users are not at the location of the experience
Users can physically move in the environment	Users cannot physically move in the environment

What is AR SDK?

- SDK is a kind of augmented reality software, and it stands for **Software Developer Kit** and is essentially a bundle of programs and software used to develop other software.

- 5 tools for AR creation that are popular and valued in the development community.

1. Vuforia

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- Vuforia is an AR SDK that sits near the top of most “Top AR” lists.

- key features that make it one of the best for **object recognition and 3D modelling**
- These features include
- **Ground Plane** (for adding content to horizontal surfaces),
- **Visual Camera** (expands supported visual sources beyond mobile phones and tablets), and
- **VuMarks** (custom markers that can be used in Vuforia face recognition and also encode data).

2. Wikitude

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- Wikitude is another great choice for AR software development.
- Wikitude is suitable for developing apps for **iOS, Android, and Smart Glasses devices.**
- also incorporates **geolocation, cloud recognition**.

3. ARKit

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- ARKit is the go-to application for the development of **augmented reality software developed by Apple**, so it is not possible to use ARKit for **Android phones.**

- ARKit tutorial materials and updates (ARKit 1.5, ARKit 2, ARKit 3) with every new version of iOS

4. ARCore

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- ARCore comes with the standard bundle of AR features (motion tracking, surface detection, light estimation), as well as several advanced features, such as
- augmented images (custom responses to specific types of 2D shapes and objects) and
- multiplayer (rendering of the same 3D objects on different devices simultaneously)

5. ARToolKit

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- ARToolKit is an open-source and free-to-use SDK available for AR development for devices on different platforms.
- Apart from Android and iOS, ARToolKit is used for AR apps on Windows, Linux, and OS X.

- features included in the latest build are
- tracking of planar images and simple black squares,
- natural feature marker generation, real-time speed support, and easy camera calibration.

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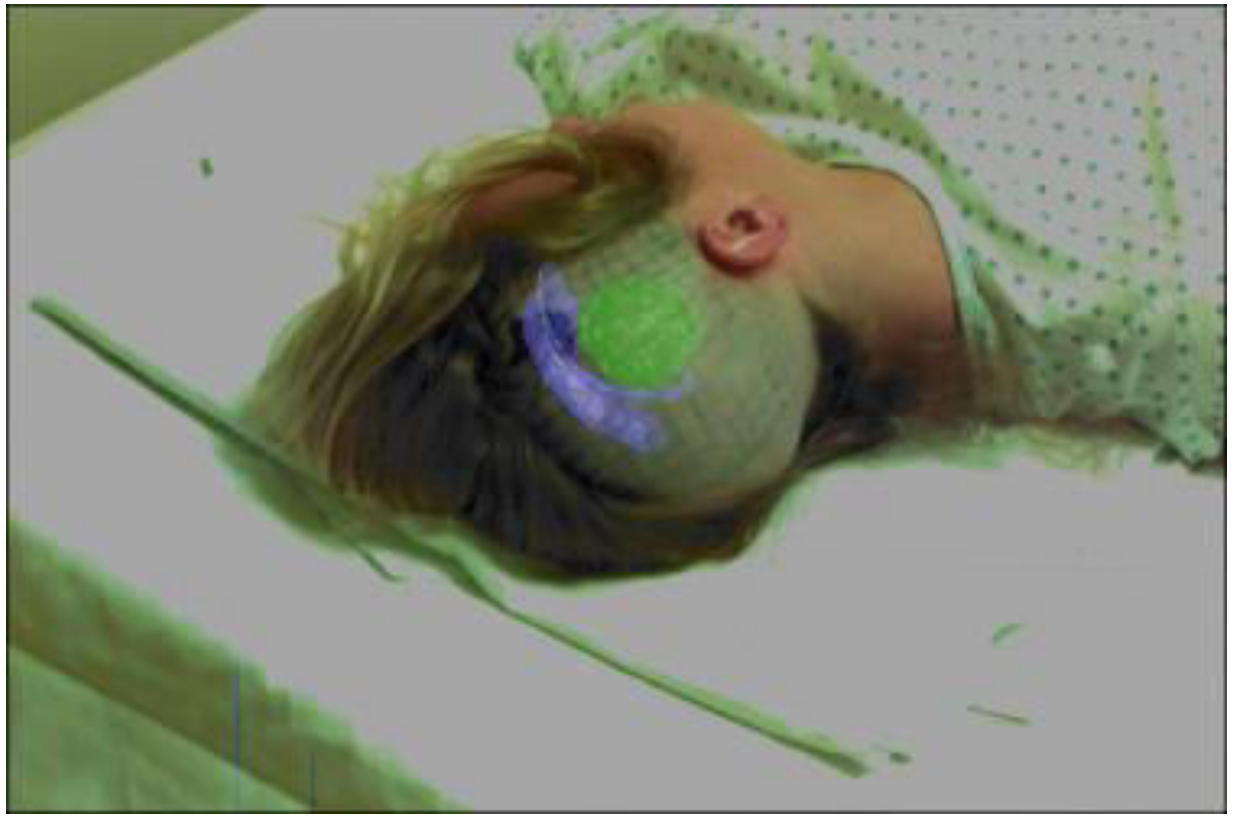

Example

- An experimental augmented reality system in which a surgeon sees a **brain tumor highlighted within the brain** during surgical planning or to guide a biopsy needle .

- Given how difficult it is for the surgeon to accomplish this task, such a development would have very large benefits.

- Other applications for augmented displays include **aircraft maintenance, where the mechanic sees instructions and structural diagrams superimposed on the actual machinery.**

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- tactical military displays, in which the pilot or tank driver sees indicators of friendly or hostile targets superimposed on a view of the landscape;

- and shopping, where information about a potential purchase appears next to the item.

How does AR work?

Augmented Reality (AR) uses a combination of cameras, sensors, and computer algorithms to overlay digital information onto the real world. When you look through an AR device, such as a smartphone or smart glasses, the device captures the image of the real world and then adds digital content on top of it. This digital content can be anything from text and images to 3D models and animations.

To achieve this, AR devices use a process called SLAM (Simultaneous Localization And Mapping). This involves mapping the physical environment in real-time and tracking the user's movements within it. By doing so, the device is able to accurately place digital content within the real world, making it appear as if it is part of the environment.