**A Survey of Augmented Reality Technologies Applications and limitations**

**ABSTRACT**

This paper describes the field of AR, including a brief definition ad development history, the enabling technologies and their characteristics, including limitations as well.

**1. INTRODUCTION**

AR is this technology to create a "Next Generation ,reality based interface " and is moving from laboratories around the world into various industries and consumer markets.

**#### 1.1 Definition**

On the reality-virtuality continuum, AR is one part of the general area of mixed reality. Both virtual environment and argumented virtuality, in which real objects are added by a virtual one. In contrast, AR provides local viruality. An AR system includes these three aspects of definition.

\* combines real and virtual objects in a real environment;

\* registers(aligns) real and virtual objects with each other.

\* runs interactively, in three dimensions ,and in real time.

Finally, removing real objects by overlaying virtual ones, approaches known as mediated or diminished reality, is also considered AR.

**#### 1.2 Brief history**

The first AR prototypes ,created by computer graphics pioneer IVan sutherland and his students in the 1960s and used a see-through to present 3D graphics. From 1970s to 1980s , during this time mobile devices, digital watches and personal digital organizers were introduced.

This paved the way for wearable computing in the 1990s as personal computers could be worn. Now mobile platforms exist that may support AR.

By 2001, MRLab finished their pilot research ,and the symposia were united in the international symposium on mixed and augmented reality , which has become the major symosium for industry and research to exchange problems and solutions

**\*\* This survey provides an overview of important technologies ,applications and limitations of AR systems.\*\***

**\*\*In Section 2 : After describing technologies that enable an augmented reality experiences.\*\***

**\*\*In Section 3 : We review some of the possibilities of AR systems.\*\***

**\*\*In Section 4 :We discuss a number of common technological challenges and limitations regarding human factors.\*\***

**\*\*Finally ,we conclude with a number of directions that the authors envision AR research might take.\*\***

**2. ENABLING TECHNOLOGIES**

Both tracking and registration techniques rely on environmental models, often 3D geographical models.

**###### 2.2.1.1 Modeling techniques**

Creating 3D models of large environments is a research challenge in its own right. Automatic, semiautomatic, and manual techniques can be employed.

**##### 2.2.2 User movement tracking**

Compared to virtual environments ,AR tracking devices must have higher accuracy, a wider input variety and band-width, and longer ranges.

**###### 2.2.2.1 Mechancial , ultransonic, and magnetic**

**###### 2.2.2.2 Global positioning systems**

**###### 2.2.2.3 Radio**

**###### 2.2.2.4 Inertial**

**###### 2.2.2.5 Optical**

**###### 2.2.2.6 Hybrid**

**#### 2.3 User interface and interaction**

Our technological advancing society needs new ways of interfacing with both the physical and digital world to enable people to engage in those environments.

**##### 2.1.2 New UI paradigm**

WIMP (windows ,icons, menus , and pointing), as the conventional desktop UI metaphor is referred to, does not apply that well to AR systems. The interfaces have to support selecting , postioning, and rotating of virtual objects, drawing paths or trajectories, assigning quantitative values and text input.

**##### 2.3.2 Tangible UI and 3D pointing**

Early mobile AR systems simply use mobile trackballs, trackpads and gyroscopic mice to support continuous 2D pointing tasks.

**##### 2.3.3 Haptic UI and gesture recognition**

TUIs with bidirectional, programmable communication through touch are called haptic UIs, haptics is like teleoperation ,but the remote slave system is purely computational.

**##### 2.3.4 Visual UI and gesture recogntion**

In stead of using hand-worn trackers, hand movement may also be tracked visually,leaving the hands unencumbered. A head-worn or collar-mounted camera pointed at the user's hands can be used for gesture recognition.Through gesture recognition,an AR could automatically draw up reports of activities.

**##### 2.3.5 Gaze tracking**

Using tiny cameras to observe user pupils and determine the directions of their gaze is a technology with potential for AR.

**##### 2.3.6 Aural UI and speech recognition**

To reach the ideal of an inconspicuous UI, auditory UIs may become an important part of the solution.

**##### 2.3.7 Text input**

Achieving fast and reliable text input to a mobile computer remains hard.Standard keyboards require much space and a flat surface,and the current commerical options such as small, foldable, inflatable,or laser-projected virtual keyboards are cumbersome, while soft keyboards take up valuable screen space.

**##### 2.3.8 Hybrid UI**

With each modality having its drawbacks and benefits,AR systems are likely to use a multimodal UI.

**##### 2.3.9 Context awareness**

The display and tracking devices discussed earlier already provide some advantages for an AR interface.A mobile AR system is aware of the user's postion and orientation and can adjust the UI accordingly.

**##### 2.3.10 Towards human-machine symbiosis**

Another class of sensors gathers information about the user's state.

**##### 2.4 More AR Requirements**

Besides tracking, registration, and interaction, Hollerer and Feiner mention three more requirements for a mobile AR system.

**###### 2.4.1 Frameworks**

AR systems have to perform some typical tasks like tracking, sensing ,display and interaction.

**###### 2.4.2 Networks and database**

AR system usually present a lot of knowledge to the user which is obtained through networks.

**###### 2.4.3 Content**

The author believes that commercial success of AR systems will depend heavily on the available types of content.

**3.Applications**

Over the years, researchers and developers find more and more areas that could benefit from augmentation.The first systems focused on military, industrial and medical application,but AR systems for commercial use and entertainment appeared soon after.

**#### 3.1 Personal information systems**

\* 3.1.1 Personal Assistance and advertisement

\* 3.1.2 Navigation

\* 3.1.3 Touring

**#### 3.2 Industrial and military applications**

Design, assembly ,and maintenance are typical areas where AR may prove useful.These activities may be augmented in both corporate and military settings.

\* 3.2.1 Design

\* 3.2.2 Assembly

\* 3.2.3 Maintenance

\* 3.2.4 Combat and simulation

**#### 3.3 Medical applications**

similar to maintenance personnel, roaming nurses and doctors could benefit from important information being belivered directly to their glasses.

**#### 3.4 AR for entertainment**

Like VR ,AR can be applied in the entertainment industry to create AR games, but also to increase visiblity of important game aspects in life sports broadcasting.

\* 3.4.1 Sporting Broadcasting

\* 3.4.3 Games

**#### 3.5 AR for office**

Besides in games ,collaboration in office spaces is another area where AR may prove useful , for example in public management or crisis situations ,urban planning ,etc.

\* 3.5.1 Collaboration

\* 3.6 Education and training

**4. Limitations**

AR faces technical challenges regarding for example binocular view , high resolution ,color depth, luminance, contrast ,field of view ,and focus depth.A number of limitations ,some of which have been mentioned earlier , are categorised here.

\* Portability and outdoor use

\* Tracking and calibration

\* Depth Perception

\* Overload and over-reliance

\* social acceptance

**5.Conclusion**

We surveyed the state of the art of technologies, applications and limitations related to augmented reality. This survey has become a comprehensive overview of the AR field and hopefully provides a suitable starting point for readers new to the field.