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Augmented Reality and Standards

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Augmented Reality and Standards

The Opportunities

Using any modern desktop computer, smart phone, or tablet, users can hear, see, or feel information associated with the real world around them in real time. The exact context for the user is determined using real time, onboard sensors such as the GPS and compass and/or the camera of the user's computing and communication device. The same contextual "capture" system is also the platform for output of visual, auditory and haptic signals. The content provided is synchronized with the physical world.

This new form of user interaction with the real world, widely known as "Augmented Reality," provides highly intuitive user experience for getting digital data (information) about what is of highest interest with the lowest effort; for instance, users get information through the camera based on what they see (where they point their device's camera) rather than as a result of entering a text string in a field of a browser, sending the request to a search engine and receiving a text response on their screen.

Augmented Reality awareness and general familiarity has accelerated in the past two years. Media and technology analysts are featuring the convergence of technologies leading to mass market availability of Augmented Reality in many reports, feature articles, and speeches. There are hundreds of YouTube™ videos and blog posts in which the promise of Augmented Reality is lauded.

Google's release of their Glass™ product for head-mounted personal display technology has greatly increased AR buzz and stimulated widespread investment and excitement. However, there remain considerable obstacles.

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The Problems

Despite the potential for enormous impact, there are many obstacles to the immediate and full-scale adoption of Augmented Reality in daily life.

AR users can engage with brands on packaging or posters with interactive logos but remained starved for continual contextually-driven experiences that are sufficiently compelling to use regularly and to gradually rely on in daily life. There are many specialized disciplines (geospatial, graphics, user interaction design among others) at the center of Augmented Reality.

Some industries and ecosystems of companies have addressed the lack of interoperability between technology platforms or suppliers by proposing or mandating technology solutions based on specifications that best meet their needs. The automotive and aviation industries, as well as military/government sectors, specify requirements based on safety and performance mandates. Frequently, when the requirements are well-specified and the markets large, partnerships between vendors develop to provide solutions with minimal need for custom integration. This is often the case, for example, in industries that require manufacturing, distribution, and storage of products. They have modular systems for object packing, tracking, and warehousing.

Professionals who have the skills to create content files suitable for Augmented Reality are rare and highly valued. Those who are trained and use AR authoring tools are struggling with the best ways to reach the largest audiences for their clients and publishers.

To reach large audiences with a high impact AR experience, the developer must re-create and publish AR interaction and files on multiple mobile Operating Systems and for a variety of devices. This development of hardware+software, implementation-specific solutions is due to the fact that, at the time of the writing of this paper, there is a lack of interoperable, modular AR components and widely agreed-upon architectures for AR-assisted information system design and deployment.

This situation is not new or unique to Augmented Reality. Many will recall how, prior to widely adopted information management systems now ubiquitous on the Web, there were technology silos for storing and formatting assets to be viewed in proprietary browser pages. When standards for object storage and content management were established, ecosystems building upon the standards and accepted practices blossomed. Today, developers of themes for Web CMS or 3D models can commercialize their skills and products to global markets, or large enterprises as well as small business customers can obtain desired results more quickly and less expensively than a decade ago.

With Augmented Reality, the needs for modular information technology architectures are high. However, the use cases are so numerous and diverse that the solutions in one high-performance industry have not been sufficiently specified and, when known, may not fully meet the needs of another industry or vertical market.

Obstacles to AR implementation

- Skilled AR Professionals are rare
- Lack of interoperability
- Fragmented platforms
- Multiple mobile Operating Systems & variety of devices
- No common IT architecture

In addition to it being just too difficult to reach audiences in a wide range of use cases on fragmented platforms, there's not a clear business model for Augmented Reality. If, however, there are easy ways to publish to large audiences, traditional business models, such as premium content subscription and pay to watch or experience, will be attractive.

The Role of Standards

Mass-market Augmented Reality could happen without open standards. There are many examples of proprietary solutions dominating the introduction and adoption of consumer products when one company provides the lowest cost, highly targeted answer to a specific need.

However, for long-term growth across many industries and for new business models with Augmented Reality to be greatly stimulated, there need to be many open and interoperable, standards-based components.

For example, standards in sensors manufacturing, calibration, control, and data fusion will increase the likelihood that an AR-assisted system will provide reliable data about a user's position and orientation in the physical world. These form the basis for a system to automatically obtain the user's context and status and, sometimes, even the focus of their attention.

Standards providing open interfaces to computational resources, storage resources, and display/presentation resources will make it possible for a developer to create an application or experience platform once and have it run on many platforms without requiring customization.

Availability of open standards-based components will benefit the users, the developers and, in the long run, the providers of products and services who benefit from a highly active ecosystem and many qualified buyers. When there are open Application Program Interfaces (APIs) and standards, users have greater choices in their hardware and software selection. More competition leads to lower cost and greater innovation. There can be faster innovation on the technology implementation and integration levels. Differentiation begins to develop in areas such as user experience design, stability, and performance. Improvements in these areas are necessary for Augmented Reality to be successful.

It Takes a Community Effort

There will need to be the collaboration of hundreds of experts with highly diverse domain skills for standards to develop and become well established in different segments of Augmented Reality. Some organizations have long recognized that they have an important role in the advancement of open and interoperable Augmented Reality. The use of Augmented Reality drives the adoption of faster, high-performance processors (which members of the Khronos Group provide) and location-based information. Since 2009, the grassroots community discussing open and interoperable Augmented Reality has consistently been in dialog with members of the Open Geospatial Consortium and the Khronos Group. The members of these two standards development organizations see Augmented Reality as central to what they provide.

In subsequent years, other Standards Development Organizations (SDOs) have very consistently demonstrated their interest in the future of open and interoperable Augmented Reality. The W3C began work on Points of Interest and later moved this work to the Open Geospatial Consortium. The Web3D Consortium has worked on AR extensions to the X3DOM standard and collaborated with other groups to develop a cross-standards method to compress and transmit 3D models for AR experiences. The MPEG group has published its standard on the Augmented Reality Application Format (ARAF). The MPEG is collaborating with the ISO/IEC JTC1 subcommittee on graphics (SC 24) to develop a global Mixed and Augmented Reality Reference Model.

The Open Mobile Alliance MobAR Enabler is a working draft for how to introduce Augmented Reality into mobile networks, and other groups such as the National Information Standards Organization (NISO) and the MIPI Alliance are regularly examining how they can support the development of alternatives to proprietary technology silos.

The commercial and research organizations that work on standards are dedicated to continuing the advancement of open and interoperable Augmented Reality and to define where the greatest efforts should be invested.

> *"For standards to be relevant, they must address a widespread need and accelerate innovation. For standards to be important there must be widespread market adoption and implementation to the point where the need is met and the technology becomes 'invisible'."*
>
> *– Christine Perey*

IEEE Standards for Augmented Reality

The IEEE has a long track record of providing standards that open large market opportunities for standards adopters, regardless of their size or industry. Today the IEEE Standards Association provides over 900 standards, and nearly 600 new standards and projects are in development. Of these, at least 20 are considered potentially relevant to the future of Augmented Reality.

The networking domain contains the largest set of IEEE standards likely to be relevant for Augmented Reality. Table 1 lists the communications protocols and standards most likely to impact mobile Augmented Reality.

IEEE P1907.1™	IEEE Draft Standard for Network-Adaptive Quality of Experience (QoE) Management Scheme for Real-Time Mobile Video Communications
IEEE 2200™-2012	IEEE Standard Protocol for Stream Management in Media Client Devices
IEEE 802.15™	IEEE Family of Standards for Wireless Personal Area Networks (PANs)
IEEE 1722™-2011	IEEE Standard for Layer 2 Transport Protocol for Time Sensitive Applications in a Bridged Local Area Network
IEEE 1722.1™-2013	IEEE Standard for Device Discovery, Connection Management, and Control Protocol for IEEE 1722™ Based Devices
IEEE 11073™	IEEE Family of Standards for Health Informatics—Medical/Health Device Communication
IEEE 802.1™	IEEE Family of Standards for Bridging & Management

Table 1—IEEE Networking Standards and Projects Relevant to Augmented Reality

There are also dozens of appropriate standards in software systems and architecture. These include the standards within the families in table 2.

IEEE 1516™-2010	IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) —Framework and Rules
IEEE P1278.2™	IEEE Draft Standard for Distributed Interactive Simulation—Communication Services and Profiles
IEEE P1828™	IEEE Draft Standard for Systems with Virtual Components
IEEE 1484™	IEEE Family of Standards for Learning Technology—Learning Technology Systems Architecture (LTSA)
IEEE 11073™	IEEE Family of Standards for Health Informatics—Medical/Health Device Communication
IEEE 1636™-2009	IEEE Standard for Software Interface for Maintenance Information Collection and Analysis (SIMICA)

Table 2—IEEE Software and Systems Standards and Projects Relevant to Augmented Reality

Furthermore, there are standards across a range of domains of relevance from display technology to the management of time, power storage and audio/video resources.

IEEE P3333.2.1™	IEEE Draft Standard for Three-Dimensional (3D) Medical Modelling
IEEE 1722™	IEEE Family of Standards for Device Discovery, Connection Management, and Control Protocol for IEEE 1722™ Based Devices
IEEE P3333.2.4™	IEEE Draft Standard for Three-Dimensional (3D) Medical Simulation
IEEE 1625™-2008	IEEE Standard for Rechargeable Batteries for Multi-Cell Mobile Computing Devices
IEEE 1725™-2011	IEEE Standard for Rechargeable Batteries for Cellular Telephones
IEEE P1873™	IEEE Draft Standard for Robot Map Data Representation for Navigation
IEEE 1588™-2008	IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems
IEEE 1857™-2013	IEEE Standard for Advanced Audio and Video Coding

Table 3—IEEE Standards and Projects Relevant to Augmented Reality in Display, Power Storage and Audio/Video Resources

In addition to these, other IEEE standards have a role in the area of physical world monitoring, which may improve the ability of an AR-assisted system to:

- Detect bodies of water, automobiles and other sources of interference with compass readings
- Differentiate between the "real" physical world and a reflection
- Detect (and quantify) proximity of humans

For more information on these and other standards of interest to developers of AR-assisted systems and experiences, please visit: http://standards.ieee.org/innovate/ar/stds.html

Conclusion

Augmented Reality has enormous potential to provide value to users, businesses, educators, and public servants. All industries will be able to benefit from the reduction in risk and acceleration in time to market with Augmented Reality. However, the lack of modular, open, interoperable, and highly scalable technologies is holding back the development and adoption of Augmented Reality in many domains, including but not limited to risk-averse industries. The IEEE seeks to address this and other obstacles through the dissemination of information, the development of relevant AR guidance in IEEE's standards and projects, and support of community development.