

ARLearn

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ARLearn: Learning activities and interaction in augmented reality

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Introduction

ARLearn (ARLearn, 2012) is a tool suite for educators and learners supporting different phases and activities during a field trip. Learners can use the ARLearn app to explore and annotate the real world, while teacher can monitor their progress in real time.

The ARLearn platform is intended for teachers that organize a field trip, but can support other serious game scenarios as well. For instance, professionals could use the app when inspecting a site a make notes that are synchronized with their current location. With a web based authoring tool, teachers can add assignments or information to a map.

Originally a tool for audio augmented reality, this software has grown over the past few years from a standalone smartphone app to a fully-fledged mixed reality application platform taking into account field-trips, serious gaming, augmented *virtuality* and a notification system (Ternier, 2012). This open source mixed reality (Milgram, 1994) application supports serious games both in the real environment as in the virtual envirimnt. The remainder of this article focuses on the real environment and illustrates this with Android client that was built for this purpose. Augmented *virtuality* is supported through StreetLearn, a Google StreetView mashup.

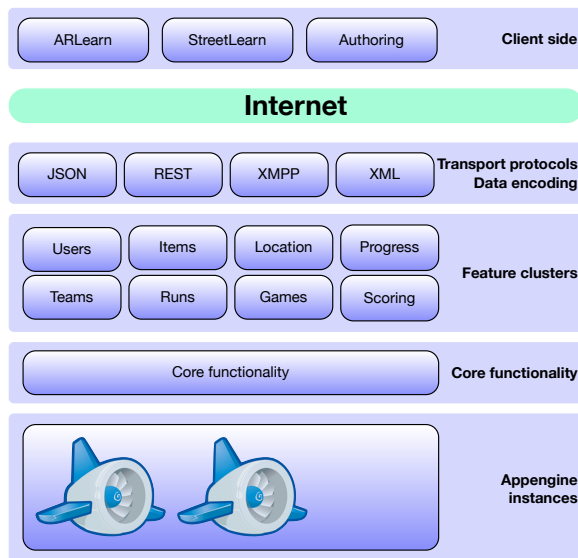


Figure 1: ARLearn architecture

The ARLearn tool suite features a client/server architecture. On the client side, the ARLearn authoring environment enables the creation and management of games (reusable instructional design) and runs (game instantiations with real time communication). With the ARLearn android client, a run can be played with mobile users. On the server side the architecture builds on the Google App Engine (GAE) stack to offer a scalable web service for content and notification management as well as game state persistence.

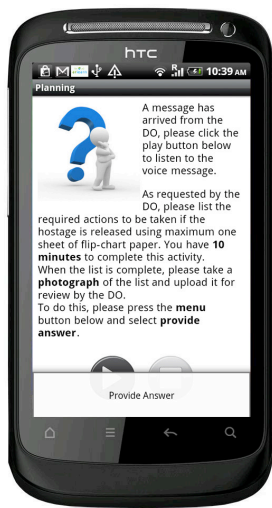


Figure 2: ARLearn app

At the top of the ARLearn architecture, the transport protocol enables communication between the clients and the backend infrastructure. Through a REST based protocol, these clients can pull data from the server. However, as new events might affect other users, a pull-based architecture is not sufficient. To support this kind of server-initiated communication, ARLearn implements a notification framework that builds on the Google channel API. This API is an implementation of the COMET web application model and allows a web server to push messages to a browser client over an http connection. The channel API works for this purpose with long-held HTTP request, for which the web server returns a response as soon as a message is available for the client

The next layer in the architecture covers the different ARLearn features. Some of the most important clusters include:

- A *game* is a blueprint for a simulation or a field-trip. Within a game media items, progress rules, scoring rules and dependencies between items are bundled. A game defines a configuration and captures whether scoring is enabled, whether a map view is enabled, etc.
- A *run* is a materialization of a game. A game can be played multiple times through the creation of new runs. A run defines teams, users and assigns roles to the users.
- A *user* is identified by a Google account. Users interact with media items and can obtain an individual score. A user can take a role, which implies that a user will receive content specific to the role and role-independent content. Users work together in a *team*. When scoring is enabled, users can compete with other teams and work together to increase the team score.

Games and runs are created with the ARLearn authoring environment. Here, an author can define various kinds of media objects.

- *Multiple choice* questions enable organising a poll and gather feedback from the user.
- *Narrator object* contains a piece of information that can be bound to a location and/or a timestamp.
- *Video Objects* and *Audio Objects* are special kinds of narrator objects and provide the user with a video or audio stream. These objects are important in creating a more realistic context.
- *Narratorial objects* feature an “open question” attribute. Using this attribute, one can turn the object into an open question, to which users can answer through recording audio or pictures.

The ARLearn architecture offers a high degree of flexibility and can be extended with other objects. For example, objects that need to be picked up and brought to a set location.

The ARLearn dependency framework enables media objects to appear or disappear when certain conditions are met. All media items can implement a `dependsOn` and a `disappearOn` attribute. When the `dependsOn` condition is satisfied, the item will appear. Similarly, `disappearOn` specifies when an item is to go away. ARLearn implements three kinds of dependencies that can be nested.

- An action-based dependency becomes true when an action has been performed by a user. For example, read a Video Object with identifier 100. Other actions are “startGame”, “complete listening to an audio sample”, “provide answer”.
- A time-based dependency binds a timespan to another dependency and becomes true after the specified amount of time has been complete since the offset dependency was completed
- A Boolean dependency expresses an “AND” or “OR” condition between 2 or more dependencies.

Furthermore, dependencies implement a scope attribute, which can take “user”, “team” or “all”. If a dependency has the scope “team”, the dependency will become true for all users in a team, once one team member has performed the corresponding action.

ARLearn is currently piloted in various projects including

- The simulation of a hostage-taking scenario in collaboration with the United Nations Refugee Agency (UNHCR).
- Teaching a second language to children aged 4-6 in the Elena project. In this project a field trip will be organized in shop. Children have to use a foreign language to execute shopping related tasks.
- Organising various trips in a public library. Here visitors will engage in tours (e.g. sadness) that will bring to books related to this subject. By scanning QR codes, users will be able to interact and influence/branch the story.

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