# Assessment Report on the Beta Release of Mobile Application

FAIMS Deliverable #15

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This report summarises the state of the FAIMS mobile application Beta release completed on 6 July 2013, after 11 sprints (22 weeks of development). The Beta release was developed with an eye to the first FAIMS deployment at an archaeological project in the Peruvian Andes, organized by one of FAIMS partner organizations. This project was selected for deployment because of having a full-time IT expert on the team who could assist with the deployment. In order to prepare a module suitable for architectural survey in the Andes, existing functionality of the app was combined and integrated in a single seamless workflow.

## Background to the FAIMS Mobile Application:

The FAIMS project is assembling modular information systems for archaeology. Our principal activity is the development of Android mobile application to facilitate digital creation of archaeological data. This mobile application is envisioned to have a number of unique features:

* Customisable data storage and user interfaces, including logic. Data schemas and UIs are created using XML definition files. Customisable logic includes defaults, validation, “duplicate any record” (or a selected record), and other automation to speed data entry—another significant advantage over competing systems.
* Full versioning (the ability to review and, if necessary, reverse all changes made to a dataset) achieved through an append-only data store.
* Synchronisation and backup across multiple mobile devices and a local server (which can run on a moderately priced laptop).
* Mapping / lightweight GIS, including the display of vector and raster data, and the manual creation of vector shapes (including linking shapes to records in the database). Includes mathematically constrained creation of vector shapes (e.g., “build me a 5x5 grid of survey units measuring 20m by 20m and create associated records”).
* File management (storing photographs, scanned drawings, digital vector drawings, audio recordings, and other arbitrary files in designated folders on the server, and connecting them to records in the database).
* Dataset compatibility from the moment of creation. As part of project setup, users can alias core concepts in archaeological recording with their own terms. This initial process replaces resource-intensive manual column mapping at the time of ingest into a repository while still producing semantically compatible datasets for regional and comparative research (a process accomplished through a novel application of localisation / internationalisation).
* Full offline functionality (everything works offline and disconnected, including the GIS).

## Glossary

**Server** – the FAIMS project server, administered during the first round of testing by the Brian Ballsun-Stanton, the test manager. Server was accessible over a local network via an access point.

**The Application** – is the FAIMS application on a mobile device that communicates with the Server. The application is downloadable from Intersect webpage (only internally so far). The Application can have a number of stored projects cached and available to users.

**Digital recording module** – denotes the digital equivalent of a paper recording sheet on a mobile device in an enhanced and interactive form. It is in effect a dynamically designed set of associated fields and functions designed to capture a specific set of research outputs and methodology, including observations and inferences. It is created on the mobile device by the upload and rendering of a particular configuration packet. There are two kinds of projects: stored module and active module.

**Active module** – also referred to as the “digital recording module”. It is the currently rendered project on the device. Only one project can be rendered at a time.

Raster layer - raster consists of a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value, or multiple values. A typical raster would be a digital elevation model or a weather map where each cell represents a particular location and has a value on elevation or average temperature. A raster may or may not be georeferenced for visualisation purposes.

**Vector layer** - in Geographic information systems, vectors denote shapes such as points, lines and polygons; these have coordinates and data associated with them. They are more lightweight than rasters

**Legacy Vector layer** - shapefiles, kmls and other spatial data that was created outside of the FAIMS application and imported in it for navigation or information purposes.

**Geotiff** - georeferenced uncompressed .tiff image, basically a raster file with embedded geographic coordinates, which will display in true position when in geographic software. Satellite or aerial photos are often delivered as geotiffs, but you can produce your own from scanned maps, using the georeferencing tools in ArcGIS

**Polygon** - one of the different vector shapes, basically a closed shape with at least three points/vertices.

**Hexadecimal codes** - hexadecimal codes are used for setting colors in the FAIMS app (beta release) “hexadecimal” (also base 16, or hex) is a positional numeral system with a base of 16. It uses sixteen distinct symbols, most often the symbols 0–9 to represent values zero to nine, and A, B, C, D, E, F (or alternatively a–f) to represent values ten to fifteen. All colors can be defined by its mix of Red, Green and Blue, each of which can be in the range: 0 to 255 (in decimal) , or 00 to FF (in hexadecimal). While is FFFFFF, pink is FF00FF, and so forth. (viz http://www.mathsisfun.com/hexadecimal-decimal-colors.html). In the FAIMS app, we use hexadecimal codes to define the colors of the various vector shapes. We have added two digits defining opacity before the hexadecimal code, so our codes will have 8 digits. If you want the color fully opaque, place FF in front of the hexadecimal code, if you want it 50% transparent, substitute the initial FF with 99.

**Direct vertex editing** - modifying the shape of lines and polygons by editing individual points/vertices/corners of a shape

**Azimuth** - is a horizontal angle in land navigation, measured clockwise from the North. It is used to indicate direction from place A to place B, in degrees (e.g.270 degrees)

## The Aims of the Beta Release

The main aim of the beta release was to integrate the existing functionality of the mobile app and present it in a simulated archaeological workflow.

We chose this approach to the Beta Release, because in software development the whole may be more than the sum of its parts and because we wanted to try out what a full deployment of an existing archaeological workflow would entail.

In the end, we modeled the workflow on an architectural survey in Peruvian Andes, a real project run by Vanderbilt University, one of FAIMS partner organizations. We chose this project as its field procedures exemplified the capabilities of the mobile application and because they had a well developed documentation, that we used as the basic requirements. Finally, the project was willing to test the application in their remote location and had adequate technical expertise present who could install and manage the FAIMS server and administer the deployment of the recording module.

The project’s basic requirements were to display georeferenced satellite imagery as a basemap, navigate using the inbuilt GPS, map archaeological features in the landscape and relationships between them, use picture dictionaries to define typology of masonry, record geospatial data, structured data, photographs and multimedia. All of this work was to be conducted offline.

We followed the instructions and produced a workflow that combined old with newly developed features, that were suited to our test project and that we believe represent some of the most important functionality for archaeological data collection. While the resulting module fails to include “all” features of the application, we believe incorporating an actual workflow is more efficient and provides a more genuine test than a comprehensive, feature-by-feature assessment.

The module arising from the beta release has the following features:

* display of multiple raster layers in true position
* display of legacy vector data
* creation of editable vector layers
* display of actual location, GPS coordinates (through internal GPS)
* recording of geospatial data (creation of points, lines and polygons) in the editable vector layers
* editing of shapes and symbology in the geospatial data
* display of labels with the geospatial data
* recording of structured data associated with the points, lines and polygons
* recording of photographs (multiple) associated with the points, lines and polygons
* recording of multimedia files associated with the points, lines and polygons
* creating of relationships among the points, lines and polygons (and associated data)
* selection of geospatial data and updating its record of structured data or multimedia
* syncing of geospatial, structured and multimedia data with the server

## Beta Release - New Features

Besides integrating the above mentioned capability into a one streamlined workflow the following new features have been successfully implemented (numbers in brackets refer to Intersect Story IDs) :

* Vertex editing of vector shapefiles [FAIMS-347]
* Layer management including styles [FAIMS-259], label display [FAIMS-257], etc.
* Loading and rendering of **multiple** imported rasters (Geotiffs) [FAIMS - 360]
* Navigation capability [FAIMS -39] including tracking [FAIMS -34] and pathing (getting directions from place A to place B [FAIMS-35]
* Measurement capability: the app is capable of measuring and displaying the distance between two points [FAIMS -262, 268], distance along a line [FAIMS -265], azimuth between two points [FAIMS -263], area of a polygon [FAIMS -264]
* Selecting geometry through database queries [FAIMS - 272, 276] in sublayers [FAIMS -277] , by intersection with other geometries [FAIMS -275], contained by other geometries [FAIMS -274], within a distance from a point [FAIMS -273]
* Display longitude/latitude of a point, create a point using lat/long (metric) [FAIMS- 253]
* Scale and north arrow in the map [FAIMS -248]
* Upgrade database to Spatialite 4.0 [FAIMS -288]
* Ability to define and customize map UI [FAIMS - 258]
* Picture taking and association with a record [FAIMS-43]
* Video capture and association with a record [FAIMS -17]
* File Attachment [FAIMS-239]
* server side editing including changes to dropdowns and vocabulary [FAIMS -359], seeing attached files [FAIMS -244], seamless file transfer from server to the tablet upon project creation [FAIMS -243];
* configuration settings page where server IP address can be entered to avoid networking difficulties [FAIMS -175]

## Issues:

### Technical

A number of bugs were revealed in the first round of testing, such as modules crashing when the GPS signal was long not available (during navigation under the roof), issues with loading new records and failure to visualize synchronized data. We had fixed these bugs and scheduled additional testing. After the second test, the application worked smoothly and all features passed flawlessly.

### Managerial

Besides the technical issues with the application we encountered a number of challenges with our experiment to deploy the recording module to a remote location in the Andes according to the specifications of the team. While the team in the Andes liked the beta module as we had created it, they found the relational structure of the recording module too time -consuming and requested a simplified version for their field testing. We had simplified and streamlined the module within a day and posted that for the field team. After fixing one outlying bug the team took the application into the field. Two weeks later we learnt that they ended up not using it because the responsiveness of the GIS drafting was still too slow for their needs and because the application crashed at a certain stage. We did not receive a bug report nor could reproduce the crash at present. Having heard of these last discoveries two weeks later we could not fix them in time for the project to take full advantage of the app.

We were sorry to have missed this opportunity, but the experience was nevertheless very instructive and showed us that frequent and reliable communication lines are an essential prerequisite for successful deployment. We were happy to see that modifying an existing module is not that time-consuming, although the production of a full module from scratch still required considerable time and effort. All of these lessons were particularly valuable as we can now use the experience during future deployments.

## Discussion:

The Beta Release of the FAIMS mobile application has been tested and reviewed with the help of external testers and FAIMS Steering Committee delegate on 28 June and 4 July 2013. The development undertaken on the Beta release of the FAIMS Mobile Application was conducted in compliance with the schedule determined during the project Elaboration Phase (and comprised within Intersect development sprints 8 -13). All tested stories passed User Acceptance Testing via user acclaim by the second round of testing.

## Summary

The Beta release of the FAIMS Mobile Application has demonstrated that its various capabilities and features may be arranged and integrated according to particular archaeological collection needs. While the deployment of a full archaeological workflow demanded a lot of time and effort from both our development team and the field testing team, the experience was very rewarding and laid basis for a deployment plan for future implementations. Besides producing a realistic and usable workflow (in fact, two of them) the new functionality introduced during this release included the vertex editing of the vector shapes, integration of multimedia with records, pathing and navigation, loading and visualization of synchronized data, data editing on the server and light module modification via the server.

The workflow and new functionality of the FAIMS Mobile Application was subject to external testing and has been validated to the satisfaction of the Steering Committee.

The development of the Mobile Application remains on schedule and will continue in accordance with the schedule determined during the project Elaboration Phase.