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Fieldfriend: A Smartphone App for Mobile Learning in the Field

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Abstract: In this paper, we describe the context, design and implementation of the Fieldfriend smartphone app for iterative and experiential field-based learning for first-year undergraduate Environments students at the University of Melbourne. Developed for Apple iOS mobile devices, Fieldfriend leverages upon current smartphone technology and ubiquitous mobile networks to afford, scaffolded and situated, field-based learning for novice learners that enables location-based self-guided learning, user-generated multimodal learning artifact generation and flexible re-use of digital content for learning. The Fieldfriend website and database enable flexible design of learning trails, assessment of students' progress, data security and sharing of user-generated content. We demonstrate how Fieldfriend was used to support learning about the earth's natural systems and processes in the Natural Environments subject. Because of the Google Maps spatial interface and smartphone GPS-enabled location services, and web-based design environment, Fieldfriend can be flexibly contextualized and designed for a wide range of mobile learning scenarios and requirements in different localities around the globe.

Keywords: Fieldfriend, mobile learning, field-based learning, smartphone, app

1. Introduction

The ubiquity of mobile technology and networks in the present time has led to a plethora of opportunities for the transformative implementation of one-to-one technology-enhanced learning (TEL) predicted by Chan, *et al*. (2006). Networked smartphones with ample functionalities, processing power and storage, and the ability to design, customize and bundle smartphone functionalities in the form of applications - "apps", mean that traditional fieldwork, an indubitably effective mode of learning (Delamont, 2002), can be transformed through the enrichment of learners' experiences using digital technology.

In this paper, we describe the context, design and implementation of the Fieldfriend smartphone app and web environment for iterative and experiential field-based learning for first-year undergraduate 'Environments' students at the University of Melbourne. Developed for Apple iOS mobile devices, Fieldfriend leveraged upon current smartphone technology and ubiquitous mobile networks to afford scaffolded and situated field-based learning for novice learners for location-based self-guided learning, user-generated multimodal learning artifact generation and flexible re-use of digital content.

2. Curricula and learning needs of Environments undergraduate students

Fieldwork has taken a central role in the curricula of the three core subjects of the Bachelor of Environments course – Natural, Re-shaping and Urban Environments, at the University of Melbourne. Current fieldwork across the three subjects require students to observe, record and reflect upon various aspects and elements of their allocated field sites, in small groups ranging from 2 to 5. This small group learning was in part a response to the size of the class which precluded the traditional 'expert guided' field excursion. Based on several discussions between academics teaching the three core subjects, it was found that students, as novices in each discipline and in fieldwork, needed expert guidance and additional learning resources to draw upon to achieve an acceptable degree of quality of observation, recording and reflection on which to build their own knowledge. This scaffolding (Wilson and Devereux, 2014) in fieldwork could be enabled by leveraging upon mobile learning approaches through the development of a smartphone app amenable for use across the three subjects totaling approximately 1000 students per semester.

Natural Environments (ENVS10001) the curricular focus of this paper, aims to provide students with a broad understanding of the Earth's natural systems structured around the four great realms, namely the lithosphere, atmosphere, hydrosphere and biosphere, and develop skills for interpreting natural landscapes, processes and phenomena applicable to a wide range of professions in the natural and built environment. Through lectures, students learn about key theories, concepts and examples associated with each of these 'spheres'. In the tutorials, students develop relevant skills and knowledge to examine the natural world through designed classroom activities. For example, in one of the tutorials, students learn how to interpret a geological map and topographic map, and discuss the formation and development of the landforms of the granite-dominated Glenrowan region in Victoria, Australia.

The *fieldwork* component of Natural Environments is embedded in the main 'semester task' assessment component which accounts for 75% of the total awarded mark. Students work together in groups of 3 to 5 and select one of eleven field sites to investigate in detail. They first compile a desktop-based background research report on the site's natural features such as geology, landforms, soils, climate, hydrology, ecology, and likely human influences. They also plan and conduct their own self guided site visits to investigate key natural features identified in the background research. Additionally, groups report their observations at an assessed 'site-visit presentation', and individuals develop a 'Landscape Function Analysis' report detailing the natural processes and features at their particular site, as the final summative assessment for the subject.

On the self-guided site visit, students would traditionally bring along references such as maps, geographic coordinates of points of interest, navigation and observation instructions in static digital and/or printed format. They would also have disparate pieces of equipment such as a magnetic compass, handheld GPS unit and inclinometer. This meant that students had to divide their energies between disparate modes and sources of information and record their observations on their individual devices or notepads. Through the development of the Fieldfriend app, we sought to build upon the multitude of options for ubiquitous learning afforded by the proliferation of mobile phones and network connectivity in present times (Sharples *et al*. 2010). Mobile learning would be used to enable effective learning by engendering social interactions enriched and mediated by digitally-enhanced field exploration, learning artifacts and discussions between learners (Vavoula, Pachler and Kukulska-Hulme, 2012; Pea, 2004).

3. Design considerations for Fieldfriend

The design of Fieldfriend was aligned with Herrington *et al.* (2009) eleven design principles for incorporating mobile learning into the higher-education learning environment to meet the range of curricular and pedagogical requirements from a range of subjects with a broad spectrum of envisioned technology-enabled authentic learning experiences (Table 1):

Table 1. Design features of Fieldfriend following mobile design principles by Herrington *et al.* (2009).

Design Principle	**Fieldfriend technological and pedagogical design**
Real world relevance	Learners situate their learning in authentic, in-the-field contexts for direct observation and interaction.
Mobile contexts	Learners traverse distances in the environment between locations and observe actively along the way – spatially dynamic.
Explore	Learners are given time to explore the app and its uses prior to and during field activity.
Blended	Learners use the app itself, related apps (e.g. clinometer) and non-technological tools (e.g. tape measure; soil pH tests).
Whenever	Learners use Fieldfriend spontaneously to capture digital records of their observations and/or reflections that may occur en-route or serendipitously – temporally dynamic.
Wherever	Learners use the app in non-traditional learning spaces; this may be reflecting on use of fossil fuels to power the transport network while on the bus or train, or water use while in the shower (personal time-space).
Whomsoever	Learners use Fieldfriend individually and collaboratively while in the field and use the learning artifacts in the database or in their smartphones.

Design Principle	Fieldfriend technological and pedagogical design
Affordances	Fieldfriend exploits smartphone functionalities which afford real-time location while exploring in the field, mobile network connectivity, multi-modal data capture and reflections and scaffolding, and collation of digital resources.
Personalise	Fieldfriend is installed on learners' own devices.
Mediation	Knowledge construction is mediated through scaffolded interaction of novice learners with their field environment via group observations.
Prod*use*	Fieldfriend provides the functionalities for learners to build their knowledge by observing, discussing about, capturing and representing elements of their field environment.

As part of the overall curriculum, teaching and assessment of Natural Environments spanning 12 teaching weeks, Fieldfriend also needed to be well-integrated into the sequence of activities in the subject, augment the effectiveness of students' experiences, and also enhance the learning taking place in these various other components. The role of Fieldfriend as integrated into the subject curriculum and scaffolding authentic learning experiences, alongside other pedagogical and assessment experiences is represented in Figure 1.

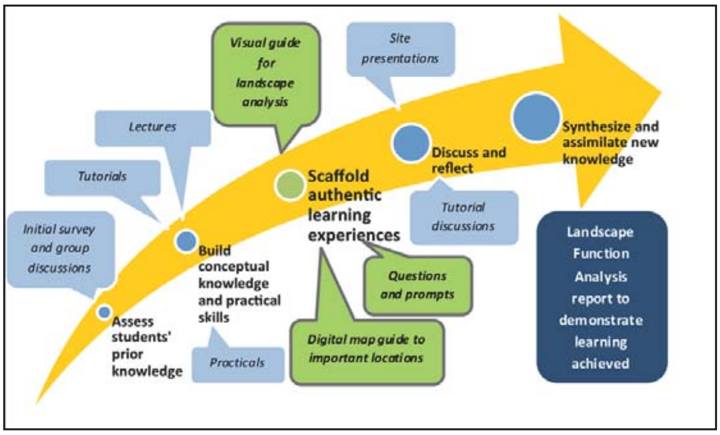


Figure 1. The broader learning design context of Natural Environments into which Fieldfriend was integrated.

In terms of the technological requirements, Fieldfriend had to be flexible and customizable by teaching academics with minimal technical expertise. However, it needed to be supported by a range of functionalities and mobile network connectivity to afford the envisioned smartphone-enabled mobile learning (see Figure 2). Fieldfriend was developed for Apple iOS mobile devices to leverage upon the technical expertise available in the University of Melbourne's Learning Environments department.

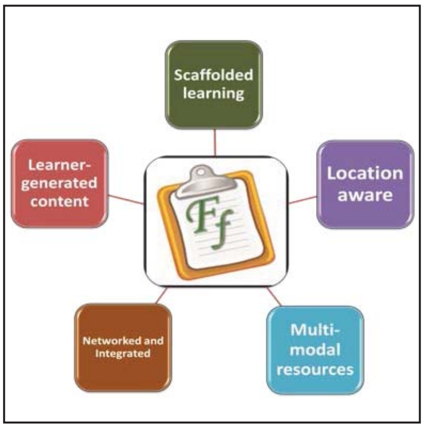


Figure 2. Key technological requirements of Fieldfriend for mobile learning in the field.

4. Fieldfriend Database and App

4.1 User management, Trip design and Setup

The Fieldfriend website was accessed at http://fieldfriend.le.unimelb.edu.au via secure University login for both staff and students. Learning designers (staff) and students were conveniently added to the Fieldfriend database by importing records from the University's Learning Management System (LMS) in the form of an exported comma-separated variable (CSV) file. Students can also be efficiently allocated to groups within the different trips by simple editing of the file.

The web-based field trip design environment was accessible and intuitive, requiring virtually no formal training to commence development. In the present paper, we illustrate key components of Fieldfriend using the Merri Creek trail, a walk along a narrow tributary of the larger Yarra River and adjacent riparian vegetation. Key learning elements included consideration of the processes and impacts of fluvial erosion, transport and deposition across two contrasting geologies (Quaternary Basalt and Silurian sedimentary mudstone and sandstone), vegetation-soil-water relationships, microclimatic effects and human impacts on the natural environment. We required the active engagement of students with the Merri Creek environment through interaction, measurement and observation of the natural physical features (e.g. rocks and rivers) and through discussion and collaboration amongst themselves.

The spatial determination of key observation points (waypoints) for these learning interactions to occur and to be supported, was of prime importance. For each individual observation point, and with reference to the key feature(s) or processes of focus, the instructor would determine the task(s), supporting information, prompts/questions, media type and student-generated responses and learning artifacts that would be required. When creating waypoints, the locational information (latitude and longitude) would automatically update as the pin was moved, with the converse also operating.

To further aid navigation, the visual and audio notification alert within the app would be set to activate as the student came within a specified proximity radius of the observation point. Depending on the desired design, an unlocking distance could also be set for the tasks to be made available to the students. With a mobile data network connection enabling access to the Fieldfriend instructor web interface, observation points could be created on-site as well. Figure 3 illustrates a set of observation points created for the Merri Creek trail.

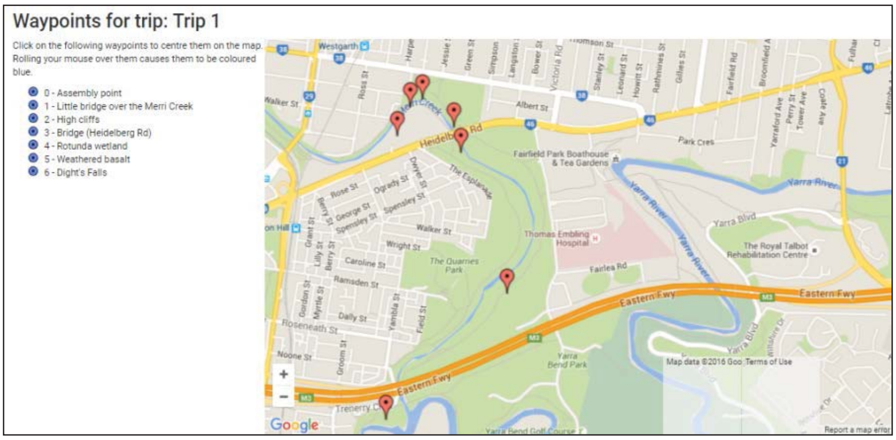
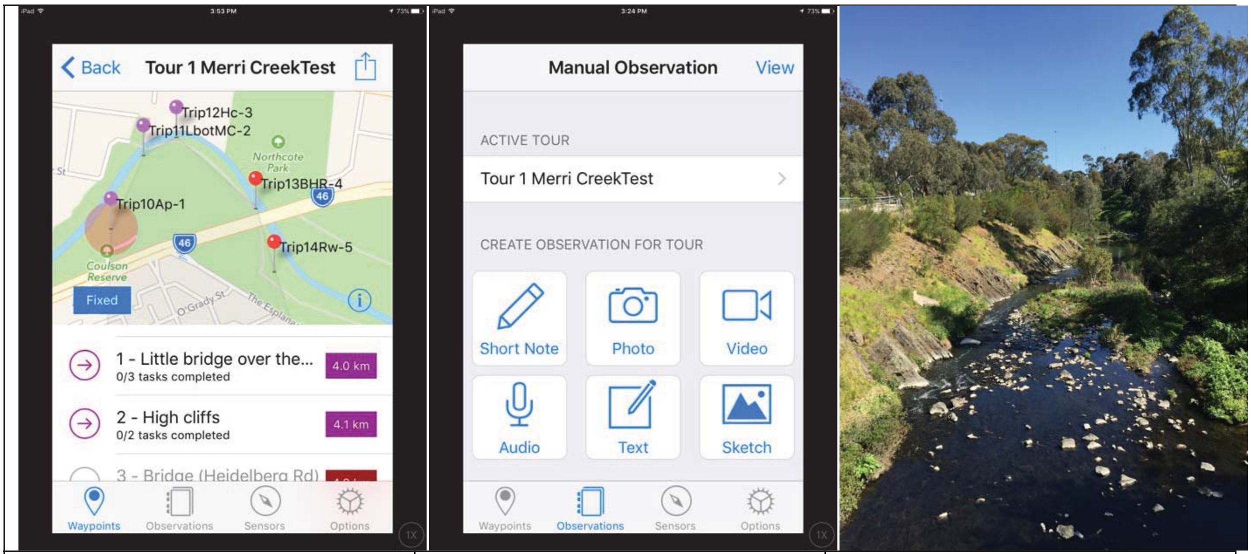


Figure 3. Google Map interface view of the Merri Creek Trip observation points for both instructors and students.

4.2 Fieldfriend smartphone app

The Fieldfriend app was distributed from a secure University subscribed download site at http://rink.hockapp.net available to registered users with University login credentials. Once installed, Fieldfriend downloaded the maps, media and waypoints associated with the trips designated by the instructors through the web-based design and management interface described above. Figures 4 (a) to (c) illustrate the Fieldfriend app environment. Functionalities enabled students to create their own observations in addition to the given waypoints, in various formats. All located-tagged responses were uploaded *en-masse* to the University's servers when in wi-fi range using 'Upload' command.



(a) (b) (c)

Figure 4 (a) Fieldfriend navigation environment; (b) Multi-modal observation options; (c) example of location-tagged observation point photo taken by student along Merri Creek.

4.3 Automated upload and collation of student learning responses and artifacts

As various student groups completed their trails, the responses and learning artifacts were uploaded to the university servers for secure storage and access by students and instructors for a range of subsequent uses such as formative assessment, tutorial discussions and presentations (see Figure 5).

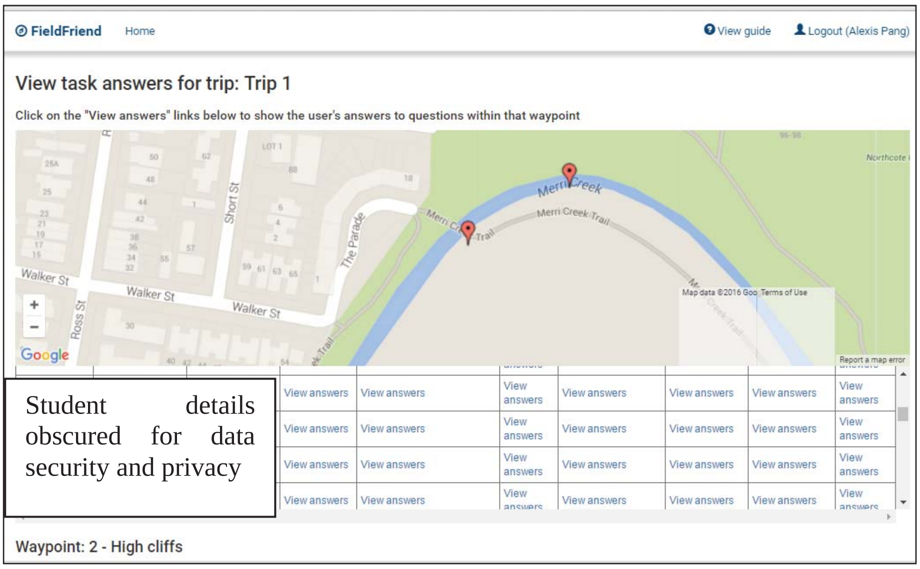


Figure 5. Web access to students' responses at designated observation points.

5. Conclusion

At the time of writing, Fieldfriend had undergone its first large-scale implementation for the first semester of 2016 for Natural Environments. As part of the overall unit evaluation survey, feedback from students was sought on the usefulness of Fieldfriend for their group site visits; the rating given by students was 5.8 out of 10 (n = 50); total cohort size was 350. This positive qualitative feedback mostly related to accuracy in directing the learner groups to the correct locations to conduct their observations. This would have increased the groups' efficiencies in traversing the landscape and enabled them to focus their energies on landscape observation and on-site discussions. Areas for improvements suggested by the respondents included even more information, structure and guidance for "things to observe”, pointing to the central importance of ‘inscriptions’ in field-based learning (Mogk and Goodwin, 2012). Some students utilized the media acquired using the Fieldfriend app from the web database for their site-visit presentations.

Fieldfriend will continue to be used in subsequent teaching semesters for Natural Environments. Based on enquiries from other Faculty, Fieldfriend could be easily adapted for use in a range of different learning contexts, including language learning (e.g. of Japanese), agriculture – soil and crop evaluation, urban studies and architecture. Fieldfriend enabled mobile learning could thus be scaled-up and utilised by different institutions.

In this initial iteration of Fieldfriend implementation, the total number of students using the app for their site visits was limited by its availability only on Apple™ iOS devices. An Android OS version is currently being developed to enable more widespread use by students and faculty. Further development will include improvements to the Fieldfriend database to have design and functionalities that engender greater collaborative and reflective learning through richer use of the acquired digital learning artifacts. A more comprehensive evaluation of Fieldfriend’s usability, aligned to Herrington *et al.* (2009), will also be implemented.

Acknowledgements

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