CONTEXTBLOGGER: LEARNING BY BLOGGING IN THE REALWORLD

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Abstract: In this paper we represent one specific instantiation of contextualised mobile social software for learning called contextualised blogging. Contextualised blogging combines the community aspects and flexible content access of a mobile blog with the adaptation to real-world settings made possible by contextualised computing. By combining both social and physical context information, we aim to improve current informal learning approaches. A special kind of data matrix symbols, called semacodes, is used to relate information from a blog to physical objects. The contextualised blogging application in this paper is developed in three steps. First, a conceptual model of the problem domain will be described. Second, a general technical framework based on this conceptual model will be developed. Finally, a specific instantiation of the technical framework called "ContextBlogger" is presented. The paper concludes with a description of the planned evaluation of the software, a summary, and a conclusion of the results so far.

Keywords: contextblogger, m-learning, contextualised computing, informal learning

Introduction

Mobile devices offer new possibilities to support lifelong learning and integrate formal and informal learning approaches. Already a couple of years ago, Rheingold recognised the power of loosely coupled, ad hoc communities "Smartmobs", which were based on mobile or ubiquitous access to personal social networks [1]. One of the possible applications of "Smartmob" technology would be instant access to learning peers in everyday life. Likewise, Koper & Tattersall [2] support the chances mobile devices provide for learning, by arguing that mobile devices offer new opportunities "to create flexible, rich and interactive learning environments". Moreover, they specifically identify the potential of mobile information access for lifelong learning as being able to reach everyone, everywhere.

Already the importance of communities to support a lifelong learning process has been stressed in educational research. For instance, the strengths of embedding learning support in authentic learning contexts and communities of practice has been argued for quite some time in the educational literature [3]. Moreover, Koper & Tattersall [2] present an integrated model for lifelong learning called a "learning network", which tries to exploit the strengths of a heterogeneous community of self-directed learners. As part of their model Koper & Tattersall present a software architecture that has its roots in social software.

Lifelong learning happens anywhere, anytime, anyplace; to support the learner in any such situation, content has to be tailored to the individual's social and physical environment. Context-aware computing investigates systems that adapt to the user's identity, preferences, location, environment, and time [4-6]. Combining the strengths of both mobile and context-aware systems and applying them to educational systems can lead to contextualised learning support as described in [7-11]. The integration of contextualised mobile systems and the learning networks mentioned earlier leads to mobile social software that aims to integrate learning into everyday life.

Blogs are a specific instance of social software and are simple tools for integrating formal and informal learning [12] and also support long-term informal learning processes [13]. In addition, blogs recently have become a popular way of collecting personal information and learning experiences related to formal education [14]. Furthermore, blogs offer learners a great degree of autonomy to structure information while also embed reflection in a peer community [15]. In that sense, blogs serve a similar purpose structuring learning processes as some other lifelong learning applications do, like for example KleOS [16] and Interactive Logbook [17].

In this paper, we will present an extension of current systems for blogging we call contextualised blogging. The instant access to blogging information possible in mobile blogging is extended and enriched by adding information about the user's current situation or context. One way of relating information to a user's physical environment is the use of identification tags attached to physical

objects or locations. In the system presented here, a specific kind of data matrix symbols, called semacodes, are used to allow users to leave "blog traces" in the physical environment. Information created can thus be directly related to certain physical objects or places that can be directly integrated in the learning process. Moreover, the interaction of learners with community-constructed content can be used to facilitate learning in a community of practice [3]. Public objects tagged with information can be accessed by learners to view connected blog parts, comment on posts by others (peer feedback), or create new blog entries with mobile authoring appliances. The aim of this paper is to provide a description of how contextualised mobile social software for learning can be shaped and to initiate our investigation of possible applications of contextualised media for learning.

The paper is structured as follows. Section two will portray a conceptual model for contextual blogging. Based on the conceptual model, a technical framework will be developed in section three. Section four gives a concrete example of a contextual blogging application called "ContextBlogger". The planned evaluation of the software is described in section five. The final section gives a summary and conclusions of the work done so far.

A conceptual model for contextual blogging

In our research of mobile social software for learning, we aim at combining both contextualised learning and community-based learning. On the one hand, learning takes place at more places than the classroom alone and by contextualising learning, an effort is made to support the learner anywhere, anytime and at anyplace. On the other hand, recent research has stressed the importance of lifelong learning in learning networks [2] to support the formation of communities-of-practice [3] using mobile social software. Therefore, the integration of both approaches provides flexible access to learning communities in almost any situation. The contextual blogging application combines social software, a weblog, with information about the context of a learner. The information in the weblog can be accessed using a mobile device, and the content can be filtered through the application of search filters based on context information. The search filters for the contextualised blogging application retrieve the content either related to a specific real-world object or to a specific user location. Furthermore, the learner can also choose to create his/her own content and relate it to a real-world object or location. Therefore, the use of contextualised blogging provides a basis for an investigation of the usage of physical artefacts in learning. On the one hand, the combination with a physical object could provide the basis for learning, on the other, shared objects could be used to build communities of practice and couple the creation of learning networks to physical objects.

Through applying different context filters in combination with the creation or retrieval of weblog content, we expect to achieve different educational effects:

- *Multiple perspectives on real-world objects*: by viewing the object's history, a certain category of blog entries, or using other filters people benefit through an indirect learning process [18, 19],
- *Community-generated content* connected to relevant real-world objects and locations: an example for the effect and importance of self-generated contents in a learning community is presented in [20, 21] about learning to operate medical devices,
- *Community interaction* and the creation of communities of interest around certain objects and locations, supporting contextualised learning.
- *Different views about objects*, based on personal preferences. Real-world objects can also be linked electronically to create relations between those objects and to create a so-called "internet of objects" [22].
- *Increase motivation through active learning*, by actively involving the learner in the learning process, the learner involvement and motivation is increased. This as opposed to passive learning in a formal classroom setting.

To achieve these education effects the underlying concepts of a system for contextualised blogging and the relations between them should be analysed. For instance, to create *multiple perspectives on real-world objects and locations*, a user should be able to interact with a physical object and should be able to retrieve content linked to that physical object. By using shared real-world objects, multiple users can interact with them, and create information objects related to them or view, rate and comment

the content added by other people (*community-generated content)*. In that way, a community of users can evolve around these shared objects and the *community interaction* leads to different opinions and perspectives about these objects. The multitude of perspectives about a shared object, can lead to either a discussion between users with different opinions or leads to reflection about a situation by the learner; either by looking at the opinions of other users, or by adding content and reading it back later, as an opportunity to reflect back on what happened before [23, 24]. To prevent the user from being overwhelmed by the amount of information available in a community contextualised search filters are used that only display the relevant information for a certain situation or context. By combining these educational effects the system addresses the lifelong learner, by providing several opportunities for the self-centred learner or a community of these learners to structure the learning process. Also the system relies on the implicit assumption of lifelong learning that the responsibility for the creation and structuring of learning content resides with the self-directed learner himself [2].

From the different kinds of interaction previously mentioned several concepts can be identified. First of all, the central concept of the system is the user or learner. A user can interact with a physical or real-world object, a context tag, an information object (content) or other users. The combination of several of these concepts can lead to several forms of interaction, as can be seen in figure 1.

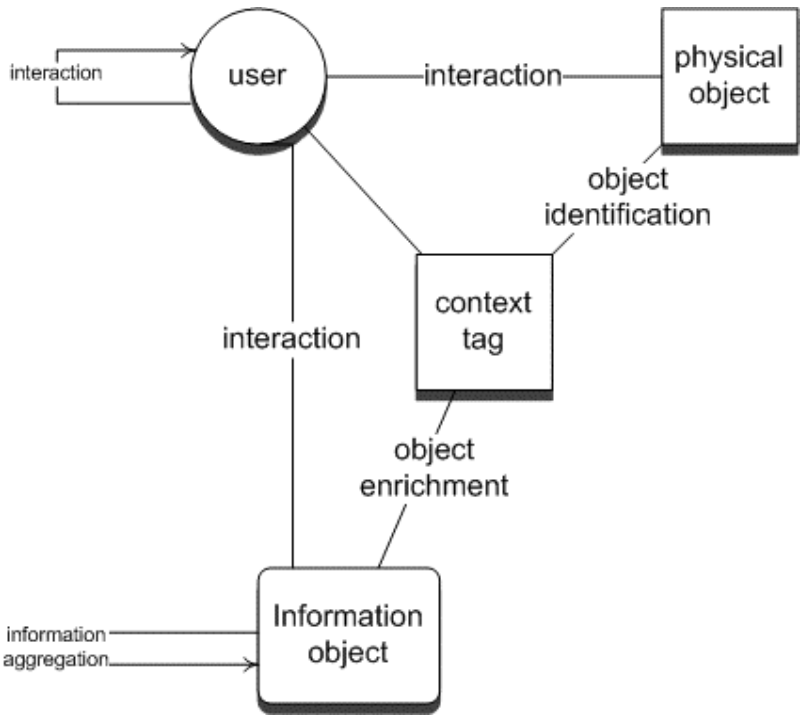

Figure 1. General conceptual model for contextual information systems based on tagging

For example, object identification can be achieved by relating a context tag to a real-world object. Users can decide to start enriching a physical object by tagging it and making it identifiable for the other users. Moreover, once an object has been tagged content can be created, attached to the objects or be displayed to other users. Therefore, the relation between a context tag and an information object leads to object enrichment. The contextual information stored in the context tag creates a kind of filter on the real-world that allows displaying information related to the current context. In this sense, the tags do not only function as a portal into the virtual world, or a way of social interaction, but also facilitate a context specific querying, filtering out all information not relevant in the current context.

Additionally, information objects can be aggregated to structure the information and provide an additional filter. The following levels of information aggregation are present:

- the entire blog, the highest form of information aggregation possible, can contain information from different users and about different object,
- blog categories, a form of information aggregation that groups similar information items, in this case similar blog entries,
- blog entries, lowest level of information possible in this model. Contains information edited by one user, attached to one object only.

The different levels of information aggregation make possible several different relations between real-world objects and information. Three possible combinations of objects with blog information are possible. First, an object can be coupled (via a tag) to an entire blog. Second, an object can be coupled to a single blog entry from a weblog. Third, an object can be coupled to a category, which makes it possible to represent specific real-world classifications or groupings often made by human learners. When categories of physical objects for instance are coupled to the same blog or blog entry, the classification takes place on the physical object level; all cars of a specific brand could be coupled to a blog about these cars. Conversely, a grouping can be represented by one physical object that is coupled to a category of blog entries; one car could be coupled to several blog entries each describing a part of the car, i.e. motor, wheels, interior, etcetera.

Figure 1 thus gives the conceptual model and provides an overview of the concepts and relations available in the system. The conceptual model will be used as a basis for the technical framework described in the next section.

Technical framework

The conceptual model already divides between information objects available in some kind of content repository on the one hand, and real-world concepts as user and physical objects on the other. The gap between the virtual and the real-world will be bridged by using the context tags that are also part of the conceptual model. The division seen in the conceptual model also reappears in the technical framework, where the following three subsystems are identified:

- a mobile client subsystem, that handles the interaction with the user in the real-world,
- a content subsystem, that stores the information that is used to enrich the interaction with the real-world objects,
- a contextual metadata subsystem, that stores contextual information that relates the context tags with the content in the system.

Each of the subsystems will be described separately in the following subsections.

The Mobile Client subsystem

The mobile client subsystem handles the interaction of the user with the system in the real-world. First of all, the mobile client acquires information about the user's context from sensors. The context information is stored in context tags that can be read by the sensors. These context tags either have a physical form, like for example RFID and Barcode tags, or give information about a specific location by using GPS or WIFI positioning. The retrieved context information is communicated to the rest of the subsystems, where the information can be used to filter the available content.

Second, the mobile client subsystem facilitates user interaction with the information objects stored in the content subsystem. The content retrieved can be displayed on the mobile client or it can be used to create new multimedia content. Moreover, also the interaction between users are made possible by the mobile client; the users can rate the already available content and add annotations for community reflection. Summarising, the mobile client provides or enhances the user interactions seen in the conceptual model by providing a way to (1) access the context information available in the context tags, (2) view the information object related to that context and (3) showing relevant content in the interaction with a physical object.

The Content subsystem

The content subsystem stores all information objects created by the users and provides a way to query and retrieve those objects. The content subsystem stores all sorts information objects, a range of multimedia content, and therefore should provide corresponding methods of retrieval (for instance, media download or streaming). Each information object is stored with a unique identifier associated to it, for later retrieval. Since, the content subsystem in contextual blogging is a weblog, all content is stored inside blog entries. Information objects thus map one-to-one onto the blog entries and the unique identifier is a URL pointing to the corresponding entry.

In addition to the storage of information, the content subsystem provides three different levels of information aggregation: on the first level the information objects are ungrouped, on the second level the object are grouped by category, and on the third level a number of categories can be grouped together. As the content subsystem is a weblog the three levels of information aggregation map onto the single blog entries, the categories of blog entries and an entire blog, respectively.

The Contextual metadata subsystem

The contextual metadata subsystem stores contextual metadata that can be used to identify a certain context. The information available from the mobile client sensors is used to find the appropriate contextual metadata and identify a physical object or location. After the identification of the user's context, the contextual metadata subsystem can query and retrieve the information objects related to a certain context. To filter the information object according to the context, the subsystem stores relations between context tags and information objects. The relation between a context tag and several information objects, also present in the conceptual model, results in the actual enrichment of a specific object or location with information. Moreover, this subsystem stores social context information about the ratings of the information objects made by a community of users.

The contextual metadata subsystem should be easily extendable for the different kinds of context information that can be measured. For now, only a relation with a physical tag, like for example a semacode [25] of RFID tag can be stored, or a physical location, in the form of a GPS coordinate can be stored.

ContextBlogger: a software instantiation of the contextual blogging framework

With the technical framework of the previous section as a guideline the ContextBlogger software was developed. The ContextBlogger software is implemented as a service-oriented architecture split up between a mobile client and a server system [26]. The mobile client is implemented using the Java Microedition technology[1)] and therefore can be used on a range of mobile phones. When the program has been started it first displays a list of all blog entries available in the system, which can be filtered down by using the mobile phone sensors to search the environment for context tags. The current version of ContextBlogger uses the mobile phone camera to scan so-called semacode tags and also allows to scan for GPS location information on devices with a build GPS sensors. The contextual information is communicated to the server and used to query for the content suitable for a certain context.

All communication from the mobile client to the server takes place via the SOAP protocol [27]. The server system groups both the content and contextual metadata subsystems. The content subsystem consists of Wordpress Blog [28] and the blog entries with the content can be retrieved and queried via a standardised XML-RPC [29] interface. The contextual metadata subsystem stores the context metadata in a relational database as relations between context tag ids and a link to the corresponding blog entries. The contextual metadata subsystem can be queried with context information, finds the corresponding blog entries and calls the content subsystem to retrieve the content. After that, the content is sent to the mobile client in XML format. The ContextBlogger software is available under an open source licence and can be downloaded on the ContextBlogger webpage[2)].

[1] http://java.sun.com/javame/reference/apis.jsp
[2] http://145.20.177.33/wordpress.contextblogger

Evaluation of the software

The evaluation of the software is planned for the second half of 2007 and will be carried out in two steps. The first evaluation will be carried on the basis of a small scale experiment within an office space. The experiment will be set up as a language game, in which the users enrich physical objects by adding content in their native language and learn a foreign language by interacting with the content added by other native speakers. By combining the physical interaction with a real-world object with the content in a foreign language we hope to make language learning easier and provide a proper context for the words learned, like for example was already done to some extend in [30]. Furthermore, according to Petersen and Divitini [31] language learners also benefit from mobile technology supporting them in a language learning community. First of all, the experiment will be used to provide an overall technical evaluation of the system and to find issues that still reside within the system before the second evaluation is carried out. Additionally, the usability of the system and the user satisfaction will be evaluated. The first experiment will also be the first source of user interaction metadata, which can be used to derive the method of analysis for the second experiment.

The second evaluation will take place as a larger scale experiment regarding architectural content. In this experiment we hope to involve a bigger user group of university students to measure the effects on a larger scale. With a bigger group also we expect to collect more data that can serve as a basis for an analysis of social networks, user-object interaction and the influences of context metadata on the learning process.

Summary and outlook

In this paper, we presented an application of mobile social software for learning that combines contextualised multimedia access with learning in social networks. The software developed allows users to create, view, rate and annotate information from a weblog and couple the information to physical objects or locations. The use of shared physical objects, enriched with multimedia content, should result in formation of communities of interest around those objects. In these communities of interest, learners with different competence levels can interact which leads to multiple perspectives being gathered around these objects. The communication between the learners, the community-generated content and the different perspectives or opinions on real-world objects should improve informal learning processes in the real-world. By enabling learning with physical artefacts we also aim at supporting lifelong learning: anywhere, anytime and anyplace.

The contextualised blogging application is gradually developed in this paper. The domain of contextualised information systems has been analysed first by developing a conceptual model. The conceptual model forms the basis of a technical framework that consists of three subsystems. First, the mobile client subsystem handles the interaction with the user and provides access to the sensors to retrieve the context information. Second, the content subsystem stores the content and facilitates querying and retrieval of the content. Third, the contextual metadata subsystem stores the context information, relations to the content and makes it possible to retrieve content according to a specific set of context metadata. The software system was implemented with the technical framework as guideline and consists of two physical systems: a mobile client and a server system. The mobile client runs on a mobile phone and uses semacodes and GPS location information to derive the user's context. The server system accommodates the content and context metadata subsystems. The content subsystem was implemented as a wordpress blog and the context metadata subsystem is a database that stores metadata about the semacodes and GPS locations linked to the content in blog entries.

An evaluation of the system has been planned for the second half of 2007. In a first small scale evaluation, the system functionality will be evaluated and tested. At the same time, the small scale evaluation will be used to derive a method of analysis for a second, larger scale, experiment. The results of the evaluation will be available in future publications.

In the future, we expect to extend the context blogger software to an integrated solution for mobile learning. A challenge for future research would be adding notifications to point out people and objects of interest that deserve special attention. The use of more complex forms of context information than location or physical object identification alone, creates a challenge that future research should certainly

investigate. Only a combined approach taking into account multiple aspects of a learner's environment would make learning truly ubiquitous and lifelong.

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