

Light CS Cooperation/Coordination

Tatiana Smirnova, Usman Akram, Jelena Marković, Tonima Mukherjee, Imran Ahmad, Abdullah Feroz, Nikitia Mehta, Sahar Vahadatii, Ekaterina Sirazitdinova, Elyas Esnaashari, Masood Azizi, Nils Jeners, Wolfgang Graether, Vo Günal, Emrah Ozkan, Lusine Stepanyan, Nasim Khadem
Email : {tatiana.smirnova, usman.akram, jelena.markovic, imran.ahmad, nils.jeners}@rwth-aachen.de

Abstract—Cooperation among people is of utmost importance in order to get tasks done. Cooperation is required at work to execute different work packages of a large scale project, at a university to share parts of an assignment with respect to deadlines and also to collaboratively plan a party. In this paper the development process, features and the very idea behind Lightweight Collaboration Suite (LWCS) will be discussed. LWCS is lightweight groupware solution, which to some extent, reflects patchwork approach idea. [1] Different cooperation/coordination modules within LWCS will also be explained.

Index Term—Cooperation, Collaborative work, Lightweight, CSCW

I. INTRODUCTION

In the recent years, Collaborative and Groupware applications have gained importance in order to fulfill the requirement of achieving a common goal. Although a large number of applications have been developed to allow users to collaborate with each other, there still exists a scope for improvement.

Moreover, in order to collaborate efficiently, users need to interact with a simple and complete system, which is somehow missing. This user demands lead us to the concept of Lightweight technology. Furthermore, as Authors in [1] found, accomplishment of different tasks in different work settings yields need for specialized tools and methods for solving them as tasks are broke down to different requirements and into different categories (authors call this “Patchwork approach”) [1]. Therefore, framework approach was found to have several breakdowns. [1]

With respect to mentioned, simple and complete but lightweight groupware solution was the idea behind LCSW. Furthermore we needed implementation of specialized tools to address different requirements during work sharing. These tools are in LWCS called modules and they are:

- LightPoll: Time management tool.
- To Dos: Creating, sharing or claiming of tasks.
- Microblog: Quick sharing of URLs (e.g. registration pages, reading material references, important announcements, locations, sources etc).
- Social module and Gamification: Two parts of LWCS responsible for exchange of data between

other modules, overall awareness and deeper engagement.

LWCS was developed by us, a group of 15 students, working together in person and remotely and using the respective tools to support collaborative work. Omitting some technical details, as a result, LWCS looks as in Fig.1.

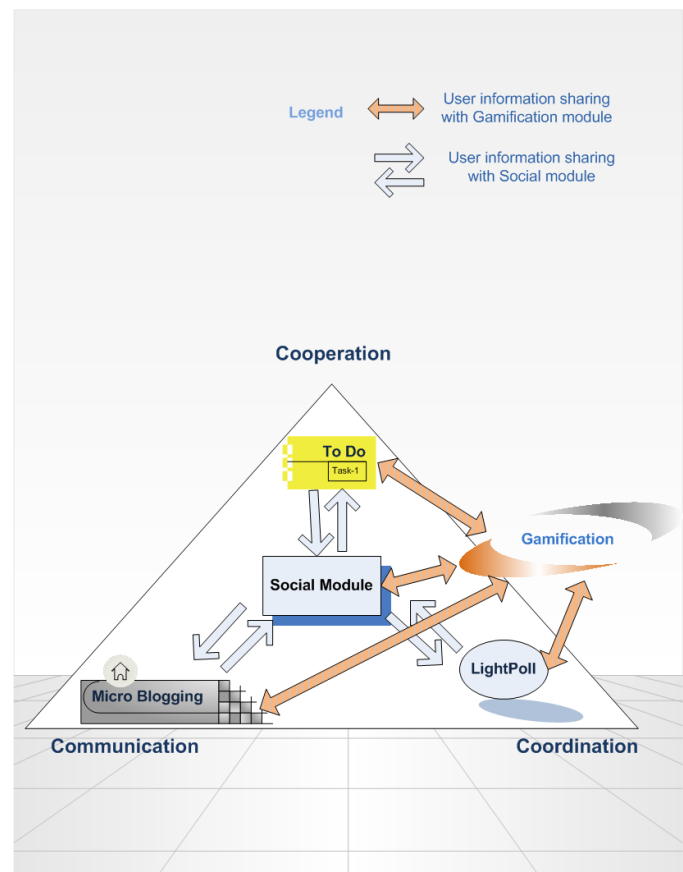


Fig.1 Integration of LWCS

II. LIGHT-WEIGHT COLLABORATION SUITE

A. Development

The system was developed during the CSCW lab course at the University. Both the system and this paper were supposed to be created in collaboration of 15 people. This immediately raises the question of coordination inside the group.

The task was to create together one integral system before the settled deadline (altogether we had approximately 3 months). In order to achieve this, at the beginning students were divided into smaller teams of 3 people to work on different modules described further. (Fig.2)

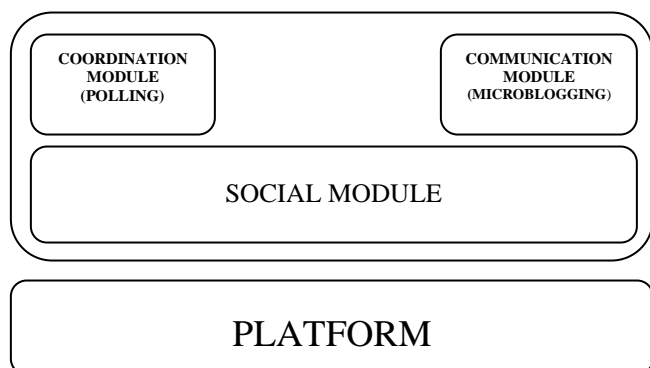


Fig.2 LWCS architecture

Each team could choose one level from the picture above and then decide what exactly to implement. This process was slightly coordinated by the supervisors, so that there was at least one group implementing one level, but at the same time we, students, had freedom to choose.

After brainstorm session each team came up with particular idea which was confirmed by the supervisors. When creating a product in a team of 15 people working on different parts of the system, there should be someone who in some way controls the process and who can see the big picture.

Therefore all the small teams created a plan with milestones at particular deadlines, and the mistake we made, was that we did not concern deadlines of each other and therefore did not have enough time for integration in the end. Integration is the biggest issue in the projects created by a group of people, and this is relevant both to creation a software system or a conference paper with a coherent text.

During the development process we had regular meetings every week and also communicated via Facebook group which was created in order to support the work. After going through this development process we had a chance to experience what tools are necessary for successful collaborative work. We had, for instance, tasks to be divided between people, meetings to be organized (time, place) and materials to be shared. So the system we were developing could be really helpful to solve our problems.

Communication instruments that we had were the mentioned Facebook group, Prezi (<http://prezi.com/>) – to create together presentations remotely, sync.in (<http://sync.in/>) – to work on the paper synchronously. Experiencing these systems allowed us to think of the important quality criteria for the suite we were developing. Such a recursive process (developing a collaboration tool, directly using other collaboration tools) was very useful for us in better understanding the principle of computer supported cooperative work.

B. Architecture and Integration

Lightweight technology is the one that involves less upfront investment, emphasizes on delivery with a focus on the services, requires less customization and reduces effort to just a few clicks.

Heavyweight collaboration applications like SharePoint (<http://sharepoint.microsoft.com/ru-ru/Pages/default.aspx>) and BSCW (<https://public.bscw.de/pub/>) [2] use 'Monolithic Groupware' with multiple features and complex interfaces which are difficult to manage. However, Lightweight Collaboration Suite (LWCS) provides an easy and simple interface by using the advanced web technologies. LWCS is divided into five different sub-modules, namely - the Social module, the Communication module, the Cooperation module, the Coordination module and the Gamification module. Each of these sub modules has been done by five groups consisting of three students working remote and face to face. Basic structure of the LCSW is implemented by using Facebook App and social plug-in(LINK) to socialize the project which allows users to see what activities other people have performed - for example, what they 'liked' or 'shared'. The ideas of different modules are as follows:

- develop a Facebook connection module integrated with social features;
- develop a communication module to post links;
- develop a cooperation module to share To do lists;
- develop a coordination module for voting (polls);
- develop a gamification module and integrate it with modules mentioned above.

The challenges include integration of social applications and collection of these applications in one system which is simple to use and complete. LWCS uses the Twitter Bootstrap which is a powerful web designing tool which leads to a smooth development of the application. It is also flexible to work with other design and scripting languages such as CSS, HTML and Java Script.

The database used is Apache CouchDB (<http://couchdb.apache.org/>) which is simple to use, powerful and stores data in schema-free manner. For this project we have used Facebook JavaScript SDK for user management.

Paradigm of CouchApp and CouchDB is quite new due to the simpler 2-layer architecture as shown in Fig 3:

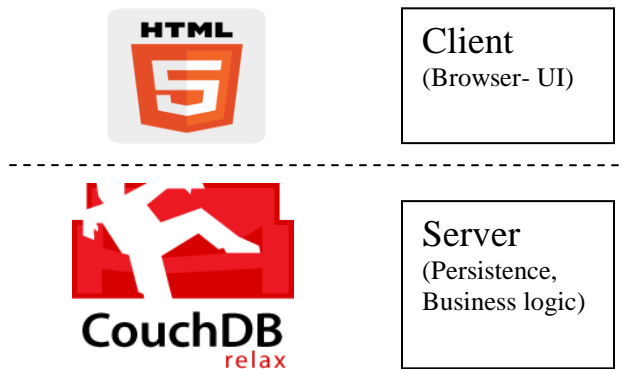


Fig. 3. CouchApp architecture

Apache CouchDB is an open source document-based database for web applications support. When the App is hosted by just a CouchDB that means it can be run from *any* CouchDB, with no need to set up complex server-side dependencies. Together with advantages, CouchDB has also brought some challenges. Since we did not have a traditional relational centralized database, creating views and queries and mapping them was a challenge.

III. MODULES

A. Poll

Coordination plays a key role in collaboration. People working on the same project have certain meeting arrangements and deadline and they need to fix some time which is suitable for the whole team. Whenever people want to organize a meeting, the most difficult task is to find a best suitable time for every participant. Non-healthy approach would be to send a chain of emails to each other or make telephone calls or SMS and these techniques become even worse when the participants belong to a larger group (Students, Business partners, Friends, etc.). Inbox are overflowed with messages in reply or suggestions from different participants, which waste both time and energy and produce some kind of chaos.

Doodle (<http://www.doodle.com>) is the most popular polling mechanism used for the event and meeting arrangement. The moderator can create an event and then copy the link of newly created event and send them manually to all participants. Participants can poll the event according to the given date and timeslots and can see the favorite date or time in the form of an ordinary table. Our task was to try to create a poll which would improve visibility of the voting results, provide simple and clear user interface and enable easy sharing of the poll with participants.

One of the advantages of LightPoll is that the user does not need to register to use it. Participants can have a quick look to the poll results in the form of interactive graph. Additionally LightPoll provides a simplified way of participants polling. Creator is able to fill necessary detail of the event including date and time without any complication; the newly created event is then shared with different participants. User is able to select an appropriate date and time according to her own

preferences from the available pool of dates and times and later on save the selection as a confirmation.

A transparent feature of LightPoll is the sharing of participant's data in the form of an easy visible chart.

LightPoll module is classified in two segments named as 1) Creator (for Owner) view and 2) User View (for participants).

Creator Segment enable the user to easily create an event by entering the 'Event Title', 'Description', 'Email' and selecting the appropriate date and time. Additionally, the user is able to add as many time slots as she wants for a particular day, for the simplicity user can easily select the date and time with 'Date and Time Picker' functionality embedded in the module. User can delete or add any new date & time in the Creator segment.

One of the most prominent features of LightPoll is the elimination of sharing of a long URL manually with other participants via individual email or through group message. In the LWCS after the successful creation of event the Creator can easily share the poll with her Facebook friends. Moreover, a poll request message will be automatically send to the selected participants with notification onto their FB account and then after accepting the 'authentication activation' request, participants are able to see and use the poll.



Fig.4 LightPoll

User Segment activates the participant to see the newly created event along with event description and the date and time selection options. Highly optimized date and time selection

matrix enable the participants to select the date and time according to their availability.

LightPoll helps both creator and the participant to view the result of the poll by just simply enabling the 'show result' feature. The most extended functionality provided by the LightPoll is the declaration of the poll in the form of simple and interactive bar charts. LightPoll module uses the 'High charts' API (<http://www.highcharts.com/>) for user friendly interactive graphical representation of polling. Additionally, Creator and the participants can easily see from the chart which date and time is most likely selected by the other participants. Moreover, by clicking on the bar chart the User is able to view the 'Number of participants' along with the specific time selected by the participants for a likely date.

Future work on LightPoll includes a history viewing of the created events or the analysis of participant's likely availability for events.

B. To-do List

The research in the Computer Supported Cooperative Work (CSCW) has shown that the efficient distribution and management of the work in terms of people, time and money can be achieved by creating and sharing To-Do lists.

Kreifelts et al. [3] have developed a prototype called "Task Manager" which consists of users (includes the creator of the list and its participants), the tasks, deadlines, services like e-mails and related documents. This prototype allows the creator to assign tasks to people which can be accepted or rejected by a user. The user interface is like an outliner program with too many multiple functionalities and heavyweight. This is ideal only for office environments for planning a meeting, brainstorming and conferencing.

Todoist (<http://www.todoist.com/>) is a to-do lists sharing tool. The user interface is attractive with all the necessary functionalities applicable to all scenarios. However, the only drawback of this tool is that it is heavyweight.

Divvyus (<http://www.divvyus.com/>) is another tool which is used for making and sharing To-Do lists. It is lightweight unlike the above two tools. However, the sharing of to do list is manual by copying and pasting the link to the particular list explicitly via e-mail.

To-Do List in our LWCS is a lightweight to-do list creating and sharing tool which is integrated with Facebook. It has a user friendly interface with the essential functionalities of creating a to-do list with multiple tasks, sharing a to-do list, viewing the list and claiming responsibility for a task and also viewing your accepted tasks.

The user interface has been designed according to the real life, in use to-do list in the form of a sticky note. As shown in the Fig. 5, the tool consists of parts *Make To-Do*, *View To-Dos* and *My Tasks*. The tool has been designed with the sole aim of keeping it as lightweight as possible.

The *Make To-Do* page consists of the list with text boxes as notebook lines for entering the to-do list name/title and the tasks. The add (*plus*) button allows entering of multiple tasks. An option for selecting the due date is also provided. The *Make To-Do* button and the *Share To-Do* button placed below allow creation of the list. Sharing allows user to choose from

her list of friends displayed in a dialog and send the created to-do list (Fig. 5).



Fig.5 To-do List

Sharing feature removes the additional redundancy to copy and explicitly share the link with the users through an e-mail client. Moreover, this tool provides flexibility to the participants in terms of choosing the task the particular user would like to do and not being forced upon. This results in better quality of work and increased productivity.

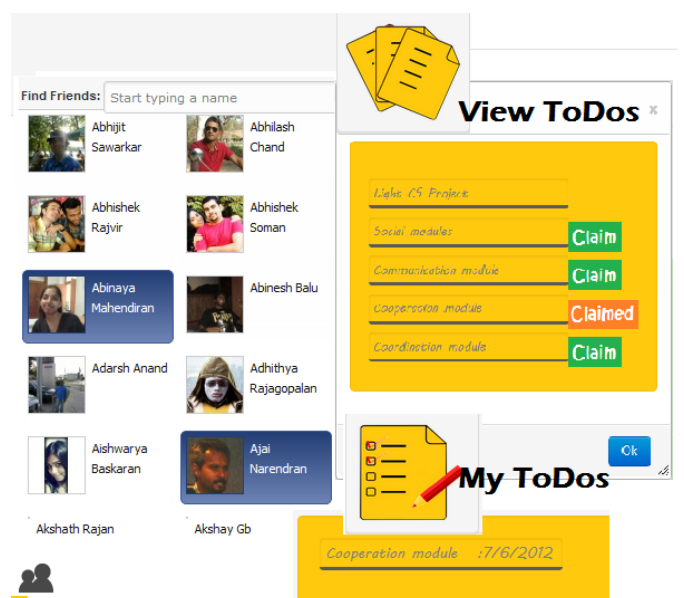


Fig.6 Sharing To-Do

View To-Dos page displays the multiple to-do lists shared with a particular user. The user can claim a task she is interested in and this change is updated and notified. When a person claims a task, it is assumed that the person takes the responsibility of completing it within the due date of the to-do

list. The necessity of additional notification by a user to the group as to her completing her task is removed as to encourage and show faith among the workers/students/people. *My Tasks* page shows the list of to-do names and the tasks accepted by a user along with a due date for the user to keep track of the tasks accepted.

This cooperation tool is aimed for general use and not limited to project teams. The design and functionality is lightweight. Cooperation among the participants is achieved by using this simple, efficient and powerful tool.

Adding features like sharing notes, allowing deletion of tasks on completion of the task and notification about the remaining duration till the completion of task are the features to be worked on.

C. Microblog

Design of CSCW modules is very often led by assumption that people follow certain procedures in cooperative work [4]. Furthermore, it is usually also assumed that information necessary for task is known or easily accessible [4]. This is not necessarily true. People tend to use shortcuts to work procedures and somehow filter information, extracting ones relevant for their work. Microblogging is small content blogging which enables exchange (just sharing (posting) or reading is also possible, though very rare) of information. This information is voluntarily accessed in contrast to an email for example (though of course email can be voluntarily neglected). In LWCS, microblogging module is designed and used exactly as a shortcut for information exchange.

LWCS microblogging component allows sharing of URLs as references to an Internet source. The concept is quite simple. If, for example, we look back to previously explained LWCS LightPoll module and creation of events, URL microblogging component could amend and enrich event activities in the following way: After a user has created an event she can share Internet sources relevant for the upcoming event posting links, such as references to recommended reading, registration page, location of event (a google map link for example) or similar.

As all user activities and thus microblogging are shown in LWCS main page as news feed, people will easily see posts relevant for their work and access the content. This results in increased awareness but can also be seen as some kind of indirect filtering of information, meaning that irrelevant content is not evaluated or even received (in contrast to mailing lists for example). This is actually achieved by use of comment field which is second mandatory input when posting a URL to LWCS microblog. *Comment* is description of the URL user is posting and should explain what the URL is about, or to what it refers to, since the URL itself is usually not very informative and contains very obscure information.

When talking about awareness and cooperative work it is usually also important to know who is engaged in which

activity. Therefore, people might want to follow and search for posts of a specific person, e.g. their project supervisor or associate, who probably share content relevant for this user. LWCS microblog provides search by person, where result are all posts of the user. Another possible search is also search by date and by tag. All these are more or less standard search options.

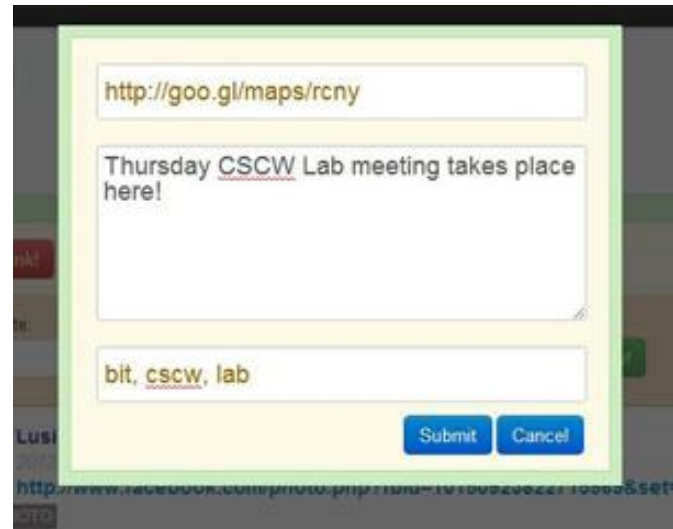


Fig.7 Microblogging – form for the post

What LWCS microblogging module offers is mediated communication. Posts are visible on LWCS news feed page and information they convey is accessible to every user of LWCS. This communication offers to people insight into other people' activities and quite often this awareness triggers new activities [5].

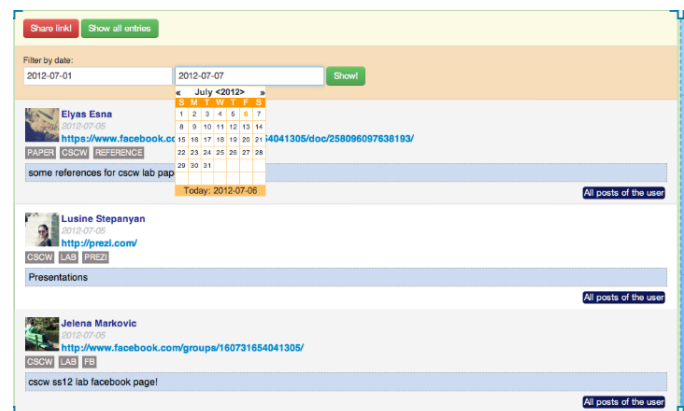


Fig.8 Microblogging - interface

One of the possible extensions to existing LWCS would be allowing comments to microposts. This would make communication interactive and enable discussions, which today for example in Facebook posts' comments occur almost in real time. However, comments very often happen to result in flood of information where users find themselves lost,

confused, misdirected or just loose too much time [6]. Therefore, comment option idea should be taken carefully and evaluated through user studies.

It is mentioned before that micropost search is possible in terms of user, date or tag and also combining these three (for example by user and by tag). New possible useful search could be by popularity i.e. number of likes or maybe number of post's views. This search is very useful and gives good glance to current events. In student community these would probably be exam results link post, or lab registration link post. These are always most visited and accessed when posted and certain time after posting.

Microblogging module could be further extended, in terms of functionality, with "subscribe to user's posts" option. It makes sense to consider this option on the upper level also, as the option for the whole LWCS. Converse option "unsubscribe from user's post" requires much more attention. While in social networks this might be fully acceptable (or no?) in business environment it would probably not be encouraged and could result in poor awareness.

D. Gamification

Gamification is a term used to describe "use of game elements in a non-game context" [7]. Competitions with opportunity to earn trophies or badges have shown a big influence on the user's behavior. Developers can get people involved in different kinds of activities by stimulating some particular actions. Depending on the goals of the system gamification can:

- increase the size of the audience;
- drive deeper engagement;
- give better visualization of user's activities;
- shows most active and influential uses;
- motivate users and encourage specific behavior;
- and even increase revenues.

The experience of modern online communities and applications like Foursquare and Stackoverflow, which are good examples of introducing gamification, has shown that people are willing to compete even for virtual goods with no monetary value. Why does gamification work? There is a number of reasons why game elements attract people:

- natural aspiration for competition;
- feedback for the actions;
- visibility of their position among others;
- sense of progress.

This fact brings us to a new way of engaging user's online activities in a variety of areas, such as entertainment, business, health and wellness, e-learning and many others. The main goal of the gamification module in LWCS is to engage users' experience and to encourage participation.

In the LWCS gamification module interacts with Microblogging, To-do tasks, LightPoll and Social module. The main idea is to give points for communication and cooperation in the system. Each activity counts some amount of points and is leading to achievement of new levels. To start interaction user needs only the Facebook login details. Integration with Facebook plays an important role in gamification module, since it lets the users share their achievements and display the results.

Levels implemented in the Light CS System are Newby, Active User, Expert and Master. If the system is adopted by specialized community, new semantics can be brought to the level naming, such as leveling from pedestrian to an officer in communities focused on vehicles and cars, or game-fans communities such as World of Warcraft [9]. This is just another instrument to manage the community, set the tone of it, and decide whether to make it more competitive or cooperative. Amount of points for achieving a new level does not have to be proportional, there should be badges which are easy to get (with first activities user already receives a badge), and others which require more effort. In the designed system there is a double scale – first for counting points in each particular module (LightPoll, To-do or Microblogging), and second with overall amount of points which should bring the user to the next level.

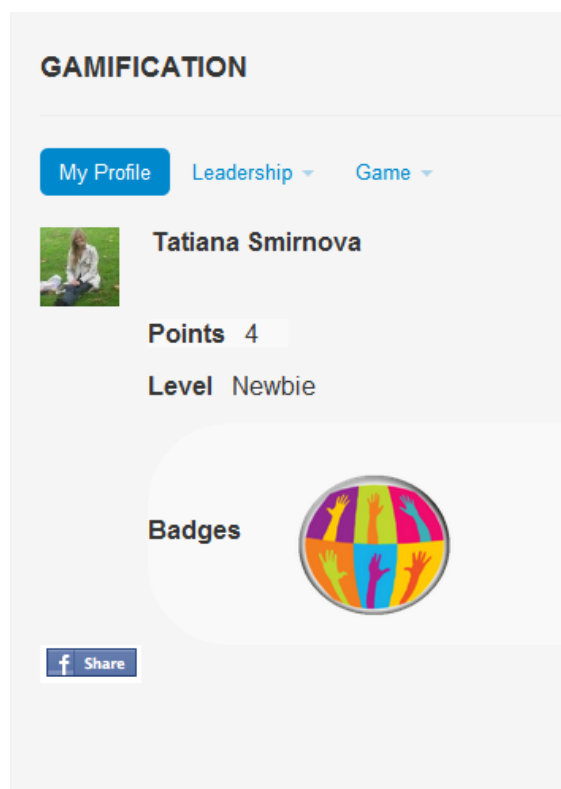


Fig.9 User profile in Gamification module

Another part which reflects the competitiveness of the system is the Leaderboard. The problem is when the user sees herself

at the very bottom of the list this can hardly motivate her. Therefore we have implemented an extra Leaderboard which shows only who is passing ahead of the user and who is behind her. This on the one hand provides awareness needed for a competition, and does not stress the user on the other hand.

Short and simple instructions are given in order to orientate user in the levels hierarchy. This is also done with the intent that psychologically people tend to escalate their efforts when they are approaching the goal [8]. The goals or the milestones for the user in this system are levels and badges.

Badges are also playing an introduction role in the system, for instance, when user sees a list of all available badges she gets to know the functionality better [8]. In the gamification module of LWCS badges were designed with an aim to semantically express the corresponding parts of the system.



Fig.10 Badges for (from left to right) activities in Microblogging, Poll and To-do list.

The functionality of the module can be extended by counting more detailed activities – ‘likes’ to the post, number of comments, number of participants in the poll – and give more points for more popular activities.

E. Social module

In every collaborative system, there exists a module which plays a role of a centralized platform exchange data between all other modules. The central part of LWCS which is in contact with cooperation module, coordination, communication and gamification modules is social module. The main tasks of the module are the following:

- integrate Facebook App and Social plugins;
- add Facebook features, e.g. ‘comment’ and ‘like’;
- socialize all the activities from all modules;
- categorize different modules;
- sort posts according to user interests;
- gather data from posts in focus of the user;
- add a learning feature by input data.

The interface of all the modules was designed in one way to support consistency. At the beginning of the project all the groups wasted time on developing their own design of the pages, because tasks were not distributed properly. In the end it was decided to stick to one common design. (Fig.11).

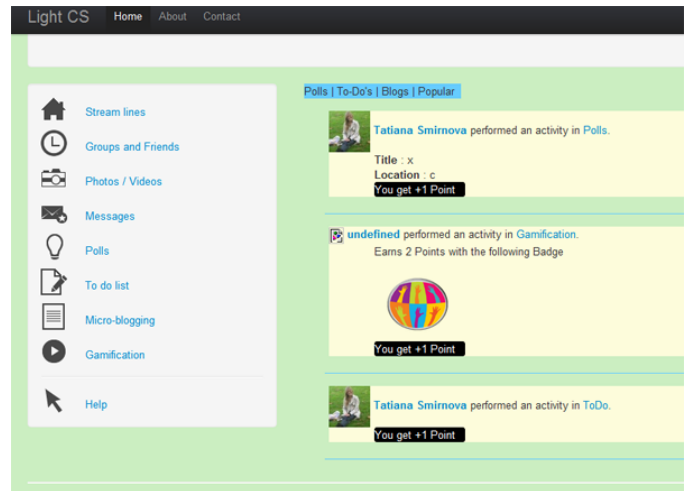


Fig. 11 Social module (common design)

Social module is the core of the system, the so-called Stream Lines (news feed) display all the activities of the users (creating a poll, to-do, posting a link, receiving a badge) and by this supports awareness (Fig. 12). It should work in an efficient way to arrange posts which come from other modules. In general, they are sorted by time priority but can be improved and then sorted for example based on users' interests.



Fig.12 Social module – Stream line

As a future work it is possible to integrate media and enable uploading videos, pictures and improve the system by managing groups as well as users in local database along with Facebook users. After a short evaluation, some users stated that they would like to have an instant messaging integrated in the system.

IV. EXPERIENCE

To apply LWCS and evaluate it in a real-life scenario, we did not have to go farther than use it for writing this paper. We

distributed tasks using To-do list (such as writing, editing sections, figures), Microblog to share links of useful references and LightPoll for organizing meetings. We found LWCS to be very responsive and interactive. Integration with the social module provided *social awareness* and *task awareness* [10] by raising activity notifications. The gamification module garnered user engagement by awarding points for each activity performed.

During the drafting of this paper, we realized that keeping the system lightweight, with the limited but essential functionality made it extremely easy-to-use. Also, inclusion of the features provided by Facebook for logging in, retrieving user data and connecting with friends, helped utilize social computing.

Furthermore, an interesting observation was made, that any action of the user (To-do or poll creation, link post) may and usually does trigger further actions. If user e.g. creates an event, interested participants will see this activity and most probably continue to contribute, by claiming tasks, posting links or voting in a poll. This way initiator is indeed just initiator and does not have burden of organizing, because actions are most probably about to occur as others are interested or already involved and therefore want to contribute.

People find it very easy and like to follow or join activity rather than start it from scratch.

V. CONCLUSION AND OUTLOOK

As a result LWCS was developed and we gained an interesting and useful experience of computer supported collaborative work. We find it an important achievement that LWCS is responsive and provides good feedback and supports awareness (thanks to social module and gamification). There are still questions left for research – mentioned improvements of the modules, proper evaluation of the system (e.g. how many users can work simultaneously, what their experience will be).

Some conclusions according to the process of the development can be done, such as the importance of good coordination in order to:

- provide proper timing and milestones;
- consider milestones of other groups working as one team;
- decide on the common solution as soon as possible (e.g. design of the pages);
- assign sufficient time for integration, testing and evaluation.

Also the work of supervisor is to see the big picture of the development process – avoid unnecessary functionality which can make the system heavier.

Collaborative work on the paper made us think of the system under development as a tool which can support this kind of work. Cooperation can enrich the content as a lot of people are contributing, fast feedback is also provided by modern systems which support simultaneous work on one document. Of course, it must be mentioned, that this methodology has its drawbacks. First of all, different people may have different opinions on the topic and this is hard to be expressed in one paper. Moreover different writing styles may be hard to be combined to make a coherent text and here the role of

supervisor is as valuable as during the software development process.

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