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Aml and Social Networks Services**

**D.5.5: Social Networking Infrastructure for patient-
patient interaction**

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Abstract (for dissemination)	<p>This document presents the social networking functions of BrainAble and the benefits that these kind of tools offer to the severe impairment. BrainAble includes the most popular social networks, Twitter and Facebook. With these services, BrainAble offers the possibility to connect to over 1000 million of users, helping to the inclusion of the impaired users of BrainAble into the e-society.</p> <p>These social functionalities were integrated thanks to the URC-HTTP technology. The URC/UCH module allows the system to communicate with the social networks and interact with them in an easy and standardized way. This way reduces the resources necessary for the development and makes possible the integration, if it is necessary, of further services in a future.</p> <p>Finally, the document introduces the BrainAble Virtual Community, the social network for the BrainAble users based on virtual reality. In this virtual environment, the avatar is free to move, to express itself, and to use the non-verbal tools to communicate with other users.</p>
Keywords	BNCI system, Virtual Reality, Ambient Intelligence, Social networks

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1 Introduction

BrainAble, an EU Seventh Framework Programme (FP7) financed project, is to research, design, implement and validate an ICT-based Human Computer Interface (HCI) composed of BNCI (Brain Neural Computer Interface) sensors interacting with affective computing and virtual environments. This combination will significantly improve the quality of life of disabled people by overcoming the two main limitations they suffer - exclusion from home and social activities - by providing inner functional independence for daily life activities and autonomy (HCI connected to accessible and interoperable home and urban automation) and outer social inclusion (HCI connected to advanced and adapted social networks services).

In terms of HCI, BrainAble improves both direct and indirect interaction with computers. Direct control will be upgraded by creating tools that allow people to control those inner and outer environments using a Hybrid Brain Computer Interface system. This hybrid approach is called BNCI and is the application of BCIs in conjunction with other physiological inputs as is the case of Electro Oculography (EOG), Electromyography (EMG), or Heart Rate). Furthermore, BNCI information will be used for indirect interaction, such as by changing interface or overall system parameters based on measures of boredom, confusion, frustration, or information overload. These self-adaptive tools will increase effective bandwidth because users will be able to use a plurality of signals to affect control, and also because adaptation will reduce errors and help provide the user with the desired control.

The aim of BrainAble is to provide support and strength to people with some type of impairment by avoiding isolation and improving their quality of life. Social networks may become technological platforms to support traditional social circles which naturally exist (family, friends or work mates). Also, with the Web 2.0 tools we can promote creativity, data sharing, and collaboration among people without take in account their disabilities.

The integration of social networking tools into BrainAble will also help to address the emotional issues related to social isolation experienced by many people with a disability. With a reduction in such isolation, mental problems associated will dramatically decrease and further opportunities for education and employment might be an outcome. Thanks to Twitter and Facebook, the user can keep in contact with their social environment and express their self in the Web. At last, but not the least, due to the virtual reality environment the user can obtain all these advantages and the possibility to use avatars to represent him and to express feelings to others in an easy and accessible way.

This document is structured as follows. In section 2, we present a short description of the benefits of social networks in the context of BrainAble. The section 3 describes the different functionalities of popular social networks which are included in BrainAble. The BrainAble Virtual Community is presented in the 4th section. Finally, the last section presents the conclusions.

2 Benefits of Social Network for severe disabled

In recent years, the use of Internet and related tools such as voice conference, text chat and e-mail opened a lot of new communication possibilities between patients and therapists. From this trend the term “e-therapy” has emerged, also known as “cybertherapy” or the “net-therapy”. These terms refer to the provision of psychological therapy and consultation over the Internet. Nowadays, these novelty methods are being applied to many healthcare services allowing patients to attend therapy sessions from home and offering several advantages for both therapists and patients, such as the possibility to deliver feedback and services avoiding distances.

There has been a good deal of research in the field of Human-Computer Interaction (HCI) on how we might sustain close relationships with others. Work has included explorations of how we might link family members who live separately, couples in long-distance relationships, and friends who find themselves at different universities. Efforts have gone into exploring how feelings of connectedness and intimacy might be maintained through the development of new technologies, or how links across generations might be supported.

The emergence of Multiplayer Online Games (MOGs) may provide a useful approach towards the implementation of multi-user applications in e-therapy. MOGs are competitive/collaborative virtual environments characterized by the simultaneous presence of multiple users within the same simulated space, who can communicate using local chat, voice, instant messaging, and in some cases even gestures and movements. Over the last few years, the number of MOGs has increased dramatically. The advantages of applying MOG systems to rehabilitation are still being evaluated on psychological therapies. However, to the best of our knowledge, motor and cognitive therapies oriented to patients affected by stroke are still excluded from these technologies.

Much of the HCI research related to relationships and communication is focused on maintaining feelings of connectedness and allowing for the expression of intimacy at a distance. In [Vetere et al.] draw a distinction between using technology to mediate intimacy and using it simply for the expression of emotion (e.g. by using emoticons or avatars like the case of MOG or Virtual Realities). They suggest that intimate acts are “ephemeral and transient yet ubiquitous and crucial” (p. 472), with the type of contact that supports intimacy being low in informational content, yet laden with emotional significance. Means of mediating intimacy are tied up with assumptions about commitment, mutuality and reciprocity, and need to strike a delicate balance across the parties involved.

MOG systems applied to cognitive stimulation, in particular in the cases of drug rehabilitation, eating disorders, social anxiety disorders, sexual disorders, post-traumatic stress disorder and panic disorder with or without agoraphobia, have been proved to have an enhancing effect both on recovery and on reducing the cost of staff therapist. The needs of elder patients, with a generally limited tolerance for technical problems and a varying degree of motivation, have highlighted the importance of remote monitoring. In addition, in the case of psychological treatments, it has been proved that the motivation of the patients is certainly increased by a multiplayer gaming experience (Andrea Gaggioli, Alessandra Gorini et al., 2007).

3 Social Functionalities in BrainAble

BrainAble has a subsystem, the Social Network Block (SNB), focussed on offering the social functionalities to the user. This block allows social interaction granting access to the most popular social networking sites such as Twitter, Facebook.

The SBN translates the different actions that the user can do inside the social network to the URC/UCH block. The URC/UCH will act as a gateway to access the traditional social networks and is the responsible of interact with the social network and to get information to send to the user.

BrainAble offers connection to two of the most important social networks available online at the moment: Twitter and Facebook. With this integration we cover a great number of users, and functionalities. We will describe these functionalities in the next points.

Twitter

Twitter is an online social networking and micro-blogging service that enables its users to send and read text-based posts of up to 140 characters, informally known as "tweets". Twitter had 200 million users in 2011 (Shiels 2011) and generates over 200 million tweets per month (Twitter 2011), making the service one of the most important social networks on the Web.

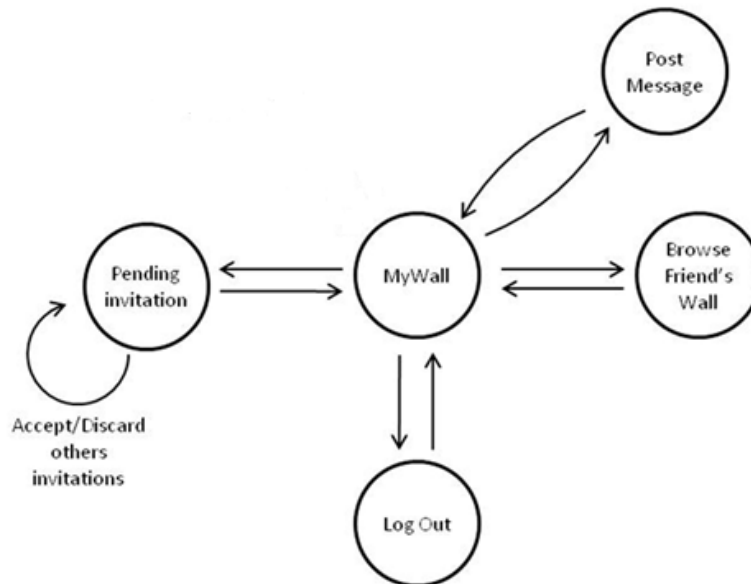


Figure 1: Functionalities of Twitter in BrainAble

The functionalities of the micro-blogging infrastructure included in BrainAble are shown in Figure 1. MyWall is the entry and central point where the user can post new tweets or read the previous written by himself or his friends. MyWall is only visible the user himself and his contacts. In the same way, the friends of the users also have other MyWall's which can be accessed to be read or posted.

Twitter site is based on the network of contacts the users are able to make up. Therefore, an effective site is dedicated to assist the users in the contact search and, once the user wanted is found, an invitation to become friends will be added to his/her list that has to be confirmed or discarded.

BrainAble integrates the most important functionalities of Twitter: post a tweet, revise the time-line with all the tweets of our contacts and visit the main page of our contacts to review only all their posts. With these actions we can communicate with the other members of the community and keep informed in a direct and easy way.

Facebook

Facebook is an online social networking with 800 million users at 2011 with an index of usage by its users very impressive: more than 250 million photos uploaded per day and more of the 50% users login every day at the social network (Facebook 2011). These numbers make Facebook a reference in the online social interaction that BrainAble has to take into account.

The social capabilities of Twitter will be extended in BrainAble by adding the connector to the social network Facebook allowing additional functionalities. The major step forward of Facebook is the inclusion of new multimedia aid to the social network. In fact, the Facebook

connector of BrainAble will allow the user to browse his own photo albums, his own mural photos/videos and also browse photos/videos from other users of the social network.

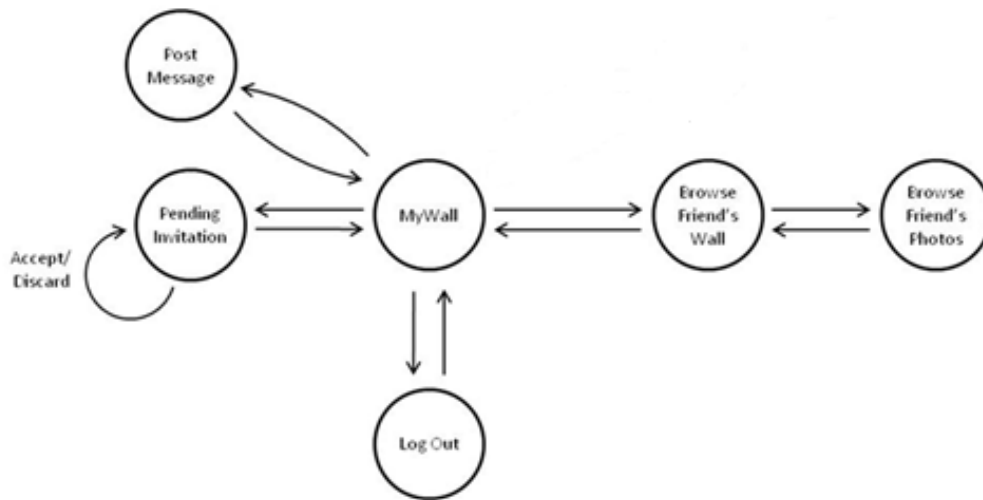


Figure 2: Functionalities of Facebook in BrainAble

The

Figure 2: describes the different actions that an user can do into the Facebook network. As we have commented, increase the possibilities of Twitter thanks to the multimedia capabilities. BrainAble does not include all the possibilities that Facebook offers, but implement the main actions such as post messages, review our wall with the updates of our contacts and visit the wall of our friends to browse their photos and status.

3.1 Connectivity to popular social network

The communication and exchange of information between the AmIBlock and popular social networks, such as Twitter and Facebook, take place using the UCH middleware. The UCH middleware acts like a gateway for the communication between the AmIBlock and these online network services, being the responsible for dealing with the details of the communication with each one of the services' APIs, and also for offering, to the AmIBlock, a standardized way to control/interact with both the social network services. As described in D2.3 and D.5.2, this standardized communication is based in two key aspects:

- **The services' Socket Descriptions (SD):** A SD is an XML document that contains the semantic model of a specific Target, and may be defined by the manufacturer of the very Target or by any 3rd party entity (as for instance the person who is integrating a new target in the UCH). The document contains and combines variables, constants, commands and notifications, and allows specifying constraints between them. This document has to be conformant with the specification as defined by the ISO 24752 URC standard. Each one of the network services, Twitter and Facebook, are described by its own SD, whose structure is explained in more detail in the following sections.
- **The URC-HTTP protocol:** This is a communication protocol, based on HTTP, for communication with the UCH. Used together with the information contained on the services' SD, it satisfies all the communication needs identified as they are expected within the BrainAble project. Among other operations, this communication protocol specifies HTTP messages to read/change the status of the devices/services that are connected to the UCH, execute commands associated to those devices/services and

establish a TCP channel to automatically receive devices/services status updates from the UCH. A full specification of the protocol is available at <http://myurc.org/TR/urc-http-protocol2.0-20091103/>.

This standardized communication approach is the same used to monitor and control the several devices and sensors used in BrainAble.

In **¡Error! No se encuentra el origen de la referencia.** an example of the interaction between the two blocks through the URC-HTTP protocol is shown. In this case the AmIBlock is invoking the “signIn” method for Twitter in the UCH, for that, it sends an URC-HTTP Message. That kind of message is specified by the protocol URC-HTTP and it is filled in with data about the “signIn” command, specified in the UI Socket document (Socket Description).

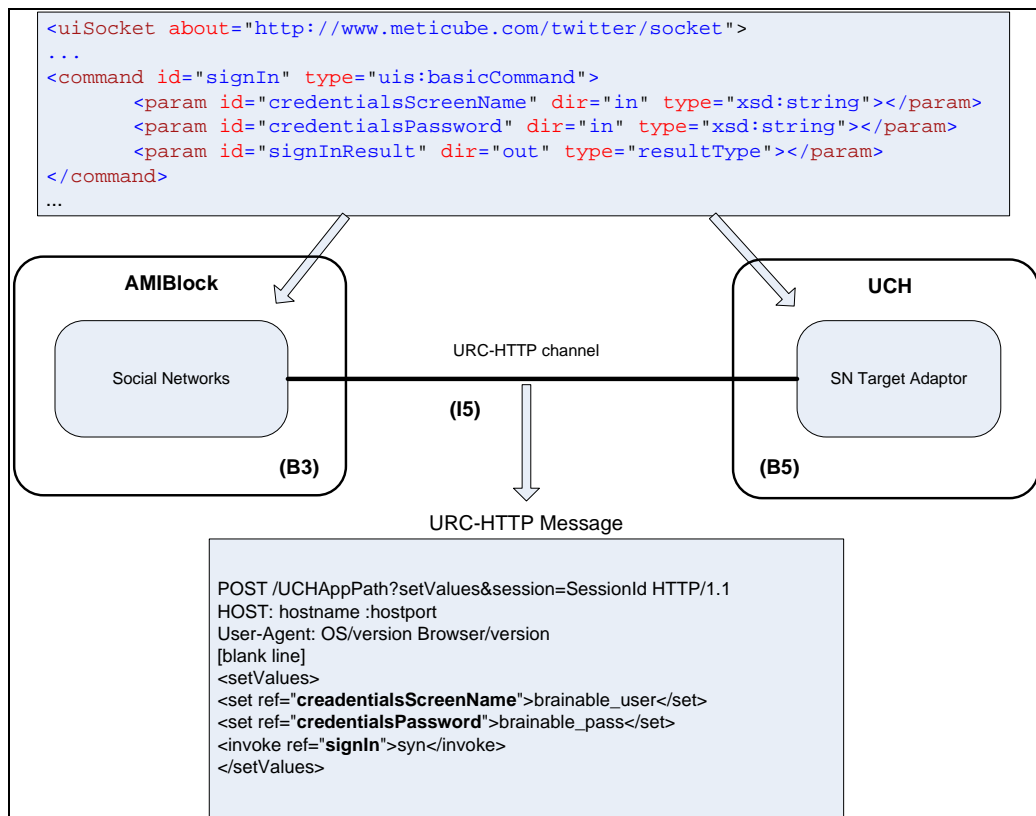


Figure 3: URC_HTTP protocol message sample

3.1.1 Microblogging service: Twitter

The Twitter is the most used microblogging service used in the world. Although, the concept behind the Twitter service is quite simple, allowing to a user to publish a sentence (tweet) that can be viewed and replied by other users. An user can also browse friends’ pages and watch/reply their tweets, search for friends on Twitter and invite or accept/decline invitations to be followed by other users, allowing them to watch the publications. Having in account the API for communication with Twitter, that Twitter has available for the implementation of clients (API documentation is available at: <https://dev.twitter.com/docs>), some of these functionalities were not available for integration.

The next table shows the group of functionalities that are available to the AmIBlock, via UCH:

Group of Functionalities	Functionality	Description
Authentication	Authentication	Log on to Twitter / Log off
Tweets	Post Message	Sent string to Twitter
	Get Messages	Gets tweets (returns a predefined number of results)
	Delete Message	Deletes a tweet
	Get Next Messages	Gets the next tweets (next page of results)
	Get Previous Messages	Gets the previous tweets (previous page of results)
Friends	Get Friends	Gets friends (returns a predefined number of results)
	Get Previous Friends	Gets the next friends (next page of results)
	Get Next Friends	Gets the previous friends (previous page of results)
	Get Friend's Messages	Get the tweets of a friend
Search	Search Friends	Search friends (returns a predefined number of results)
	Search Get Previous Friends	Gets the next friends (next page of results)
	Search Get Next Friends	Gets the previous friends (previous page of results)
Invitations	Get Pending Invitations	Gets pending invitations (returns a predefined number of results)
	Get Next Pending Invitations	Gets the next pending invitations (next page of results)
	Get Previous Pending Invitations	Gets the previous pending invitations (previous page of results)

Table 1: Twitter's functionalities integrated in the UCH

3.1.1.1 Twitter's Socket Description

Based on the set of Twitter's functionalities that were selected to be integrated on the UCH, a Socket Description (SD) was created. This SD describes the functionalities and state of a Twitter account, allowing the UCH clients to authenticate a user and to access to the profile /tweets of the logged user and the tweets of a friend at once. It may also search for users (friends or not) and see the list of pending "friendship" requests received.

The next diagrams show how this information is hierarchically organized (each block is equivalent to a set on the socket).

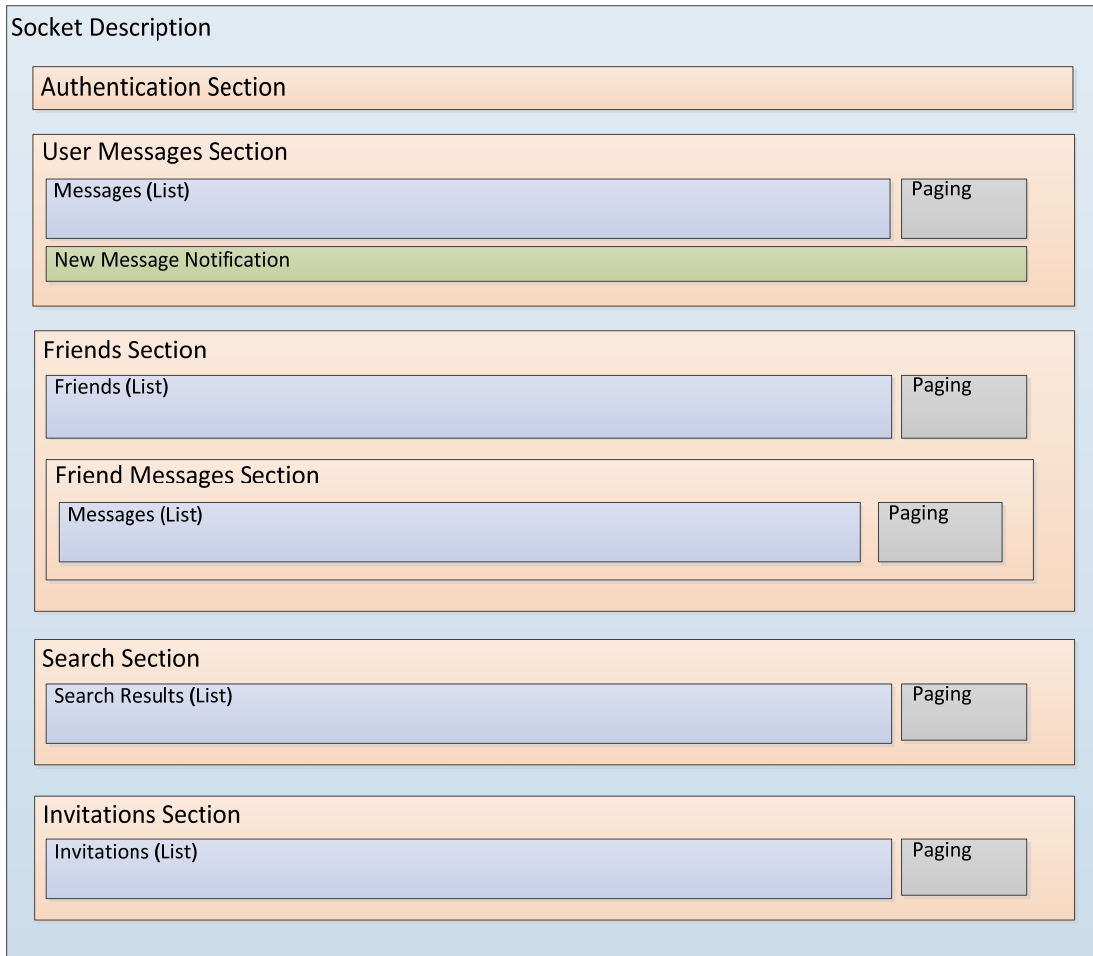


Figure 4: Twitter Socket Description overview

The diagram in

Figure 4 shows that the information contained in the socket is organized in several sections / sets:

- Authentication: login/logout states and methods
- User messages: list of tweets available on the user's wall, notification triggered when a new tweet is available. Each tweet in the list contains the tweet text, the publisher name and photo and the date.
- Friends: list of friends and list of tweets available on a friend's wall (just the wall of one friend is available at a time). Each friend in the list contains the user screen name, the full name and his photo.
- Search: list of results of a search (users) made by the user. Each user in the list of results contains the user screen name, the full name and his photo.
- Invitations: list of friendship requests received by the user. Each user in the list contains the user screen name, the full name and his photo.

3.1.2 Virtual Community Application: Facebook

The Facebook is the most known social network nowadays, offering a wide set of functionalities to its users. For the integration of the Facebook on the UCH the functionalities were restricted to the most important ones. This selection of functionalities was also influenced by the new Facebook Graph API (API that the Facebook has published in order to allow client applications to

interact with the Facebook system), which has not available all the functionalities that a user have available, when accessing via official Facebook page. The Facebook's Graph API documentation is available at:

<http://developers.facebook.com/docs/reference/api/>.

The next table shows the group of functionalities that are available to the AmIBlock, via UCH:

Group of Functionalities	Functionality	Description
Authentication	Authentication	Log on to Facebook / Log off
User Wall	Get wall posts	Get wall posts (returns a predefined number of results)
	Get next wall posts	Gets the next friends (next page of results)
	Get previous wall posts	Gets the previous friends (previous page of results)
	Add wall post	Adds a post to the user wall
	Remove wall post	Removes a post from the user wall
User News Feed (Home)	Get news feed posts	Gets the news feed posts
	Get next feed posts	Gets the next feed posts (next page of results)
	Get previous feed posts	Gets the previous feed posts (previous page of results)
User Albums	Browse Albums	Allows to browse the user's available albums
	Browse Get next albums	Gets the next albums (next page of results)
	Browse Get previous albums	Gets the previous albums (previous page of results)
User Photos	Browse Photos	Allows to browse the photos on the selected album
	Browse Get next photos	Gets the next photos (next page of results)
	Browse Get previous photos	Gets the previous photos (previous page of results)
	Browse user identified photos	Allows to browse the photos where the user is identified
	Browse Get next user identified photos	Gets the next user identified photos (next page of results)
	Browse Get previous user identified photos	Gets the previous user identified photos (previous page of results)
User Friends	Browse friends	Allows to browse the user's friends list
	Browse next friends	Gets the next friends (next page of results)
	Browse previous friends	Gets the previous friends (previous page of results)
User Pending Friendship Requests	Get pending requests	Allows to retrieve the pending friend requests
	Get next pending requests	Gets the next pending requests (next page of results)
	Get previous pending requests	Gets the previous pending requests (next page of results)
Search Friends	Search friends	Search friends
	Search Get Previous Friends	Gets the next friends (next page of results)

Group of Functionalities	Functionality	Description
	Search Get Next Friends	Gets the previous friends (previous page of results)
Friend Wall	Get Friend wall posts	Gets the posts on a friend wall
	Post Friend wall	Allows to post on the friend's wall
	Delete friend wall post	Allows to delete a post on the friend's wall
Friend Albums	Browse Friend's Albums	Allows to browse the friend's available albums
	Browse Friend's Get next albums	Gets the next albums (next page of results)
	Browse Friend's Get previous albums	Gets the previous albums (previous page of results)
Friend Photos	Browse Friend's Photos	Allows to browse the photos on the friend selected album
	Browse Friend's Get next photos	Gets the next photos (next page of results)
	Browse Friend's Get previous photos	Gets the previous photos (previous page of results)
	Browse friend identified photos	Allows to browse the photos where the friend is identified
	Browse Get next friend identified photos	Gets the next friend identified photos (next page of results)
	Browse Get previous friend identified photos	Gets the previous friend identified photos (previous page of results)
Friend Friends	Browse friend friends	Allows to browse the friend's friends list
	Browse Friend's next friends	Gets the next friends (next page of results)
	Browse Friend's previous friends	Gets the previous friends (previous page of results)
Comments	Get comments	Allows to get comments (photos, albums, posts)
	Get next comments	Gets the next comments (next page of results)
	Get previous comments	Gets the previous comments (previous page of results)
	Add Comment	Allows to add comments (photos, albums, posts)
	Delete Comment	Allows to remove comments (photos, albums, posts)
Likes	Get Likes	Allows to get likes (photos, posts, albums, comments)
	Get next likes	Gets the next likes (next page of results)
	Get previous likes	Gets the previous likes (previous page of results)
	Add Like	Allows to add likes (photos, posts, albums, comments)
	Remove Like	Allows to remove likes (photos, posts, albums, comments)

Table 2: Facebook's functionalities integrated in the UCH

3.1.2.1 Facebook's Socket Description

Based on the set of Facebook's functionalities that were selected to be integrated on the UCH, a Socket Description (SD) was created. This SD describes the functionalities and state of a Facebook account, allowing the UCH clients to authenticate a user and to access to the profile of the logged user and the profiles of a group of other users (restricted to the info that the logged user can access). It may also search for users (friends or not).

The next diagrams show how this information is hierarchically organized (each block is equivalent to a set on the socket). In order to avoid having too much complexity in a single diagram, the initial diagram is an overview of the socket Description, and the others are partial diagrams that contain more detail.

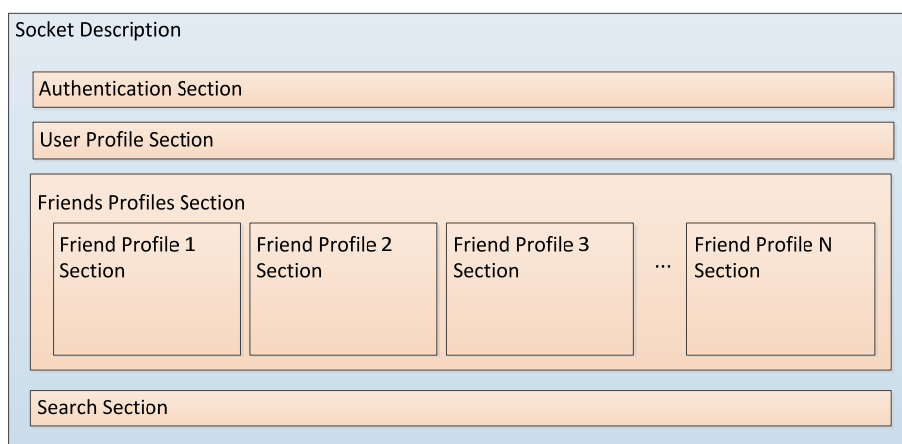


Figure 5: Facebook Socket Description overview

The diagram in

Figure 5 shows that the information contained in the socket is organized in several sections / sets:

- Authentication: login/logout states and methods
- User profile: all information directly related with the user
- Friends profiles: all information directly related with other users that not the logged user (called all as friends, simplifying). Basically, this section contains a list of profiles.
- Search: list of results of a search (users) made by the user. This list just contains the user identification and not its data. The data are represented in the friends' profiles section if the client requests its data.

These blocks are described in the following diagrams.

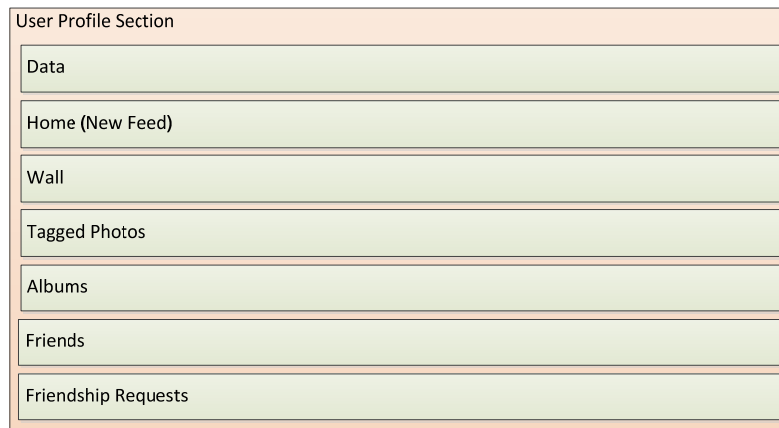


Figure 6: User profile section partial diagram overview (more detail)

The diagram

Figure 6 shows the information contained in the user profile section / set. This information was organized in several sub sets to group the states and related functionalities:

- Data: user profile data (e.g. name, birthday, gender, likes, etc.)
- Home: list of more recently added posts
- Wall: list of user wall’s posts
- Tagged photos: list of photos were the used is tagged. Includes the photos of the user and photos of friends/other users.
- Albums: list of user’s albums. Each album will contain the list of its photos.
- Friends: list of user’s friends. This list just contains the friend identification and not its data. The data are represented in the friends’ profiles section if the client requests its data.
- Friendship requests: Friendship requests received by the user. This list just contains the friend identification and not its data. The data are represented in the friends’ profiles section if the client requests its data.

These blocks are described in the following diagrams.

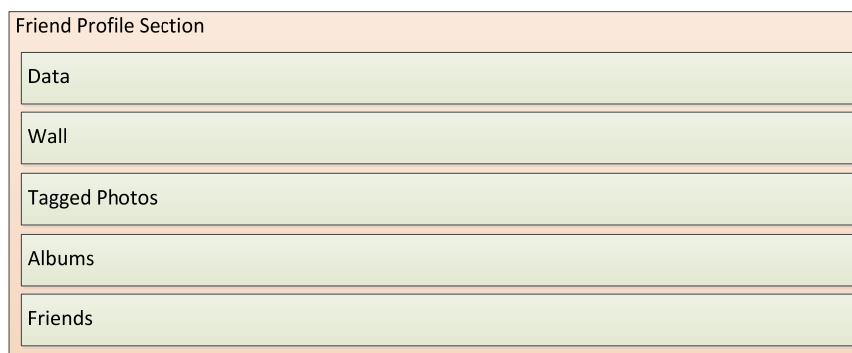


Figure 7: Friend profile section partial diagram overview (more detail)

The diagram in

Figure 7 shows the information contained in the friend profile section / set. This information was organized in several sub sets to group the states and related functionalities. It is similar to the logged user profile, but does not include some info:

- Data: user profile data (e.g. name, birthday, gender, likes, etc.)

- Wall: list of user wall's posts
- Tagged photos: list of photos were the used is tagged. Includes the photos of the user and photos of friends/other users.
- Albums: list of user's albums. Each album will contain the list of its photos.
- Friends: list of user's friends. This list just contains the friend identification and not its data. The data are represented in the friends' profiles section if the client requests its data.

These blocks are described in the following diagrams.

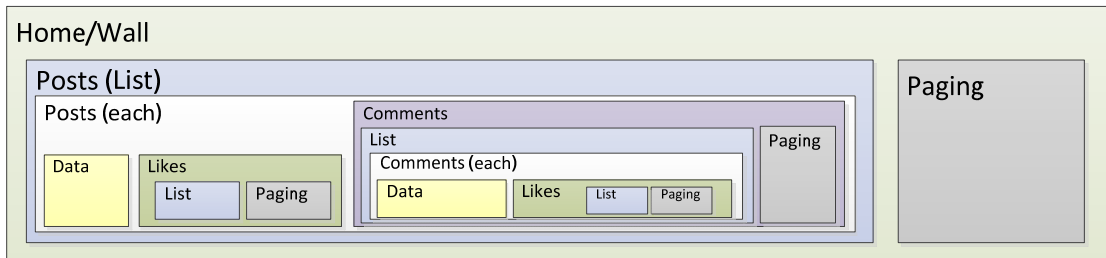


Figure 8: Home/Wall section partial diagram overview for user and friends profiles (more detail)

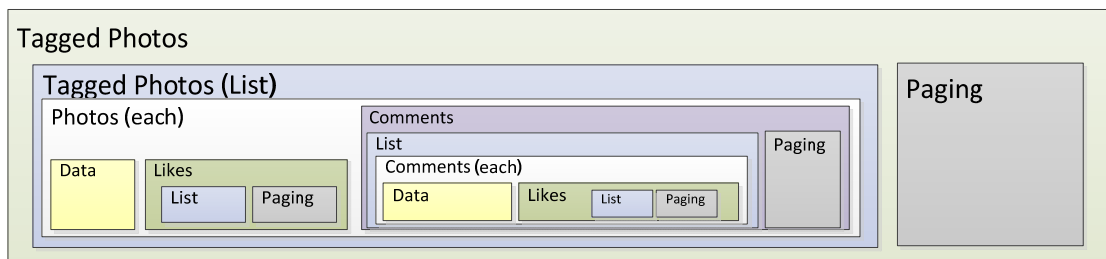


Figure 9: Tagged photos section partial diagram overview for user and friends profiles (more detail)

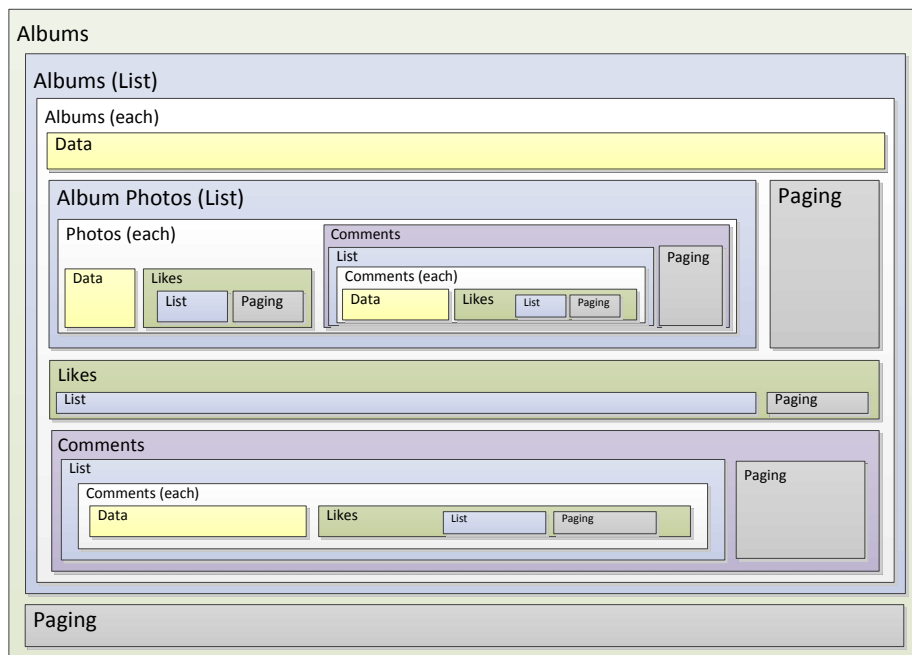


Figure 10: Albums section partial diagram overview for user and friends' profiles (more detail)

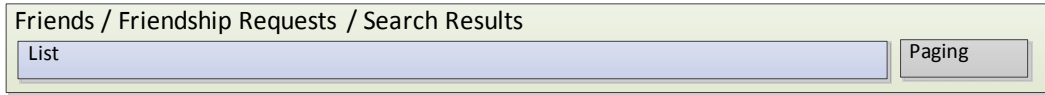


Figure 11: Friends/friendship requests/search results section partial diagram overview for user and friends profiles (more detail)

4 Social Networking with Virtual Reality

4.1 Technical solution of the BrainAble Virtual Community (BVC)

The BVC is the virtual space where users can interact with other users connected to the virtual world. In this virtual environment the avatar is free to move, to express itself, and to use the non-verbal tools to communicate with other users.

For the avatar representation different systems were evaluated. Initially it was evaluated the use of SmartBody (Thiebaut 2008), a character animation system that use the Behaviour Markup Language (BML) to control the character. This library is very powerful to control the avatars and especially in the context of BrainAble to send high level commands from the BCI. On the other hand the systems doesn't allow to easily customize the characters and to use the characters in a networking environment in Unity3D engine.



Figure 12: SmartBody avatar

Finally it was decided to integrate the use of Unity3D avatars, from the example that is offered by the engine it was created new designs for the avatars to give them a human-like aspect and the ability to integrate the avatars in a networking environment.



Figure 13: Unity3D avatar. On the left side original look of the avatars. On the right side the customized characters developed for BrainAble VR and BVC.

The BVC is based on the architecture of network videogames¹ where two players connected from different locations can play the same game in real time. In BrainAble the solution is achieved through the network capabilities offered by the Unity3D game engine. The solution is implemented with a dedicated server that waits for BrainAble users to connect to the BVC. Users connect to the server (identified with an IP address) and are authenticated to join the BVC where all his actions are visible to other users connected. The actions are propagated through Remote Procedure Calls (RPC).



Figure 14: Avatars of different BrainAble users interacting in the BVC

The BVC is designed as a social interaction place, it is represented as an open space to give the idea to the users that is leaving his/her house (BrainAble VR) to go outside and interact with other users. In this area the users can explore the world with the same navigation actions as the VR, and it offers social interaction tools like the capabilities to express emotion to other users. From the BVC the user can go back to the BrainAble VR or can go to an area where he can customize his avatar.

5 Conclusions

This document presents the social networking functions of BrainAble and the benefits that these kind of tools offer to the severe impairment. Also, it was discussed about the services and technologies used to integrate them into BrainAble. It reviews the benefits of the new technologies such social networks and virtual reality communities. The possibilities offered by these new ways of communication with our relatives or therapists are here included, and how can improve the evolution of the patients and how reduce the isolation suffered by the user.

BrainAble includes the most popular social networks, Twitter and Facebook. With these services, BrainAble offers the possibility to connect to over 1000 million of users, helping to the inclusion of the impaired users of BrainAble into the e-society. This e-inclusion improves their quality of life reducing their isolation and allows them to express their selves without any help by their careers.

These social functionalities were integrated thanks to the URC-HTTP technology. The URC/UCH module allows the system to communicate with the social networks and interact with them in an easy and standardized way. This way reduces the resources necessary for the development and makes possible the integration, if it is necessary, of further services in a future.

Finally, the document introduces the BrainAble Virtual Community, the social network for the BrainAble users based on virtual reality. In this virtual environment, the avatar is free to move, to express itself, and to use the non-verbal tools to communicate with other users. Moreover, the BVC helps the user to reduce the isolation thanks to the representation of an open space to give the idea to the users that is leaving his/her house, which is represented on the BrainAble Virtual Reality, to go outside and interact with other users.

¹ http://en.wikipedia.org/wiki/Multiplayer_video_game

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