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D5.2 Prototype of the platform

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History

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0.1.1	A Capiluppi	May 3rd, 2015	restructured outline
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1.0	Zhenchen Wang	June 4, 2015	Addressed the comments from internal review
1.1	A Capiluppi	June 8, 2015	Final fixes

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List of Acronyms

API	Application Programming Interface
SMP	Social Media Platform
GUI	Graphical User Interface
JSON	Javascript Object Notation (format)
enum	Enumeration (data type)
ISNP	ISS-EWATUS social-media platform Web Portal
ID	ISS-EWATUS social-media platform Dashboard
IDS	ISNP data sensing
RS	Reward store
GCP	Gamification content presenter
ES	Evaluation support
WUV	Water Use Visualizer

WUVP	Water Use Pattern Visualisation

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1.

Introduction

This report presents the supporting documentation for the prototype developed for D5.2 "Prototype of the platform, R0". An online version of the SMP[1] (Social Media Platform) prototype with a temporary Web domain address is available to all project consortium members and developers for testing. A final publicly accessible version will be announced in month 24 as planned. A release plan is provided in Appendix A.

The goal of this deliverable is to fulfil the tasks defined in Task 5.2 'Software and architecture design of the social-media platform (M2-M18)' and T5.3 '' which include:

- the software prototype of the SMP and deploy it on a accessible Web server, and

- the detailed design documentation and APIs specification of the core features of the SMP.

The SMP prototype consists of a set of software components that were developed based on the requirements, design and architecture specification from Deliverable D5.1[2].

The rest of this report is organised as follows:

- Section 2 summarises how the prototype addresses the requirements from Deliverable D5.1.

- Section 3 describes the design and implementation of the software components that are integrated in the SMP prototype.

- Section 4 describes deployment details for the SMP platform.

- Appendix A provides a release plan for the SMP

- Appendix B documents the User guide for the SMP GUI

- Appendix C documents a cross-platform gamification mobile phone application that is being designed and is going to be integrated with SMP prototype.

- Appendix D documents the APIs of the implemented SMP

    2.

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[1] http://watersocial.org

[2] http://issewatus.eu

Requirements Addressed by the Prototype

Deliverable D5.1 outlined a set of use cases under different scenarios for the SMP platform.

In the first release of the SMP, i.e. R0, weprimarily focused on addressing the associated use cases for user access and social network activities support. The following table (see Table 1) summarises how the current version of the SMP as of Month 16 addresses the use case requirements and the expected releases (see release plan in section 4).

ID	Name of requirement	Description of how current version addressed the requirements / When to be addressed
U-HS1-1	Joining ISS-EWATUS social-media platform	The **IDS APIs** described in section 7.1 allows a user to register as a new user. There is also a **user registration interface** we presented in section 5.2 that can be used by user to do the registration. This feature is addressed in Release 0.
U-HS2-1	Social network reuse – contact import	This feature is partially supported by the **user meta data** model described in section 3.2.2 allows to hold additional user contact information. This feature will be fully addressed in Release 1.
U-HS2-2	Social network reuse – send invitations	This feature is partially supported by the **user meta data** model described in Section 3.2.2 allows to hold additional invitation information. This feature will be fully addressed in Release 1.
U-HS2-3	Social network reuse – recommending friends to users	We will recommend friends based upon user profile e.g. recommending based upon similar total points. The profile information can be retrieved from the **user meta data** model described in section 3.2.2. jh1` This feature will be fully addressed in Release 1.
U-HS3-1	Social network increase experience level	The **RS APIs** in sections 7.3 allows to create a reward for a user. This feature is addressed in Release 0.
U-HS4-1	Water consumption leader board	This feature is partially supported by the **user meta data** model described in section 3.2.2, the leader board will be

		based upon the defined points data field. The feature will be fully addressed in Release 2.
U-HS4-2	Water consumption rewards claim	This feature is partially supported by the defined **post meta data** described in section 3.2.2. This feature will be fully addressed in Release 2.
U-HS4-3	Water consumption visualisation and comparison	This feature is partially supported by the defined **post meta data** described in section 3.1.2. This feature will be fully addressed in Release 2.
U-HS5-1	Voting other users based upon posted content on the Web.	This feature is partially supported by the defined **post meta data** described in section 3.1.2, which allows to hold voting information on a post. This feature will be fully addressed in Release 1
U-HS6-1	Validating information	This feature is partially supported by the defined **post meta data** described in section 3.1.2. The validation will be based upon the voting information on a post related to U-HS5-1. This feature will be fully addressed in Release 1
U-HS7-1	Water consumption tips seeking	The **IDS APIs** described in Section 7.1 allows a user to retrieve a **forum post** or an **activity post** to the SMP. The **forums user interface** in section 5.6 and **activity wall** on landing page in section 5.3 both also allow user to seek tips. This feature is addressed in Release 0.
U-HS7-2	Water consumption tips post	The **IDS APIs** described in Section 7.1 allows a user to submit a **forum post** or an **activity post** to the SMP. The **forums user interface** in section 5.6 and **activity wall** on landing page in section 5.3 both also allow user to post ideas and to reply other users. This feature is addressed in Release 0.
U-HS8-1	Initiate Discussions	The **IDS APIs** described in Section 7.1 allows a user to submit a **forum post** to the SMP. The **forums user interface** in section 5.6 also allows a user to initiate a topic for discussion. This feature is addressed in Release 0.

U-SS1-1	Pushing information to app users	The **message interface** in section 5.11 allows a user to send messages to others. This feature is addressed in Release 0.
U-SS1-2	Receiving notifications	The **message interface** in section 5.11 allows a user to view notifications. This feature is addressed in Release 0.
U-SS2-1	Conducting Online Surveys	This feature is partially supported by the defined **post meta data** described in section 3.1.2, which allows to define custom survey data fields. This feature will be fully addressed in Release 3.
U-SS2-2	Participate in Online Surveys	This feature is partially supported by the defined **post meta data** described in section 3.1.2, and it is a front end. The feature will be fully addressed in Release 3
U-SS3-1	Social Network Mashup	The feature is partially supported by defined data in section 3.1.2 and section 3.2.2. We will fuse the **post and user data** defined. This feature will be fully addressed in Release 3.

Table 1 Requirements addressed by the current prototype and to be addressed in the target releases

3.

Design and Implementation of SMP Prototype

The components, as identified in the deliverable D5.1, are shown in Figure 1 (with the indication of which of the WP tasks they will be implemented in). These components seek to fulfil the scenarios and the associated use cases defined in the D5.1 via three **modules**. The modules are associated to three types of inter-component **interactions**, defined below:

1. Social Network Activity and Water Use Visualization
2. Gamification and
3. Evaluation.

In order to support an iterative development strategy, we also created an online version in the form of wiki pages [3] which is available for all project consortium members. We will periodically update the online version as the development progresses.

In the next few sections, each of module is presented in terms of process model, data model and their current deployment status in the prototype system.

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[3] https://bitbucket.org/issewatuswp5/social-media-platform/wiki/Home

user name: issewatusreviewer

password: reviewerissewatus
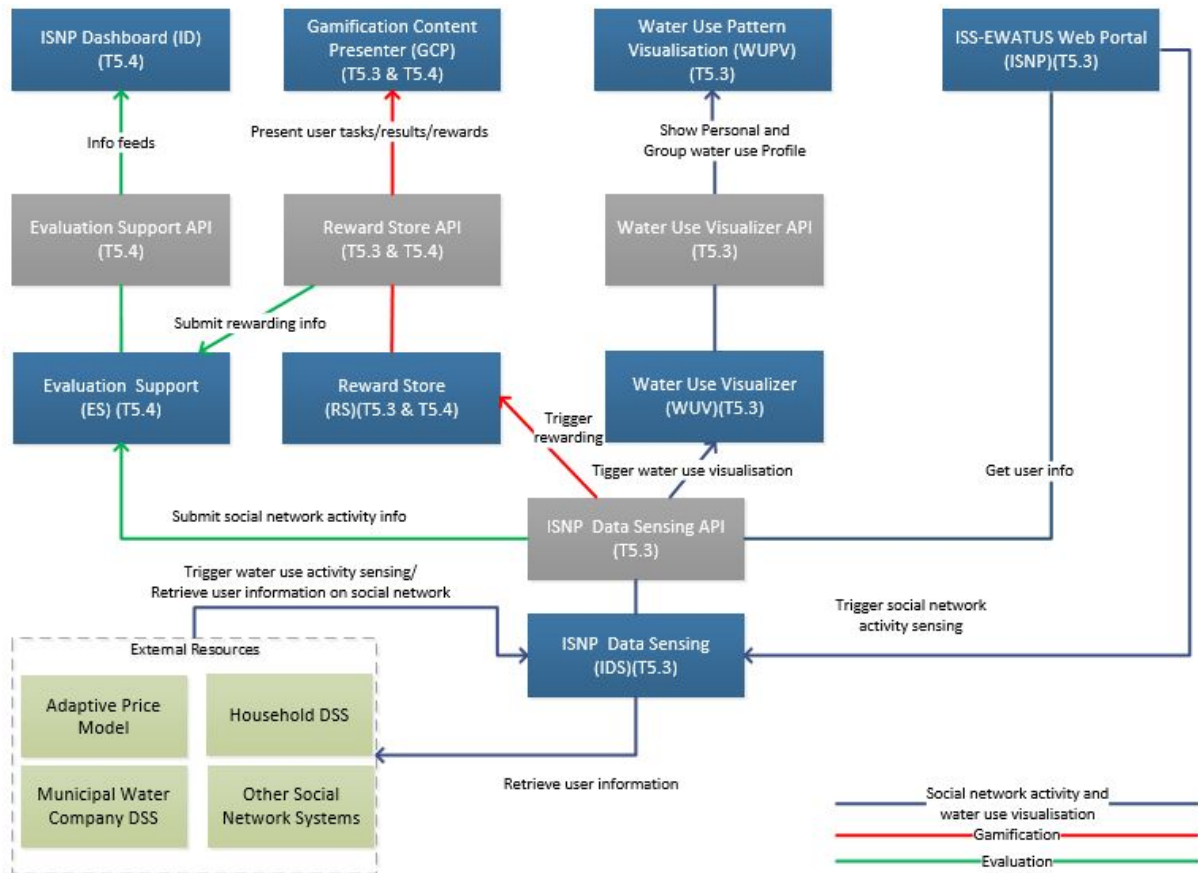
Figure 1 ISS-EWATUS SMP Components

3.1. Social Network Activity and Water Use Visualization

This inter-component interaction has the purpose of handling, for each user account, the **user account management**; the **social network activity management**; and the **water use visualization**. The allowed interactions are two-fold:

1. **internally** to the SMP, its components interact through this layer at the user-level;
2. **externally**, the interactions also extend to components outside the SMP, such as the household DSS (within the ISS-EWATUS scope) and the other social network systems (outside the ISS-EWATUS scope) to allow them to retrieve information provided by the platform.

The components *internal* to the SMP that are involved in the interactions are

- ISS-EWATUS Web Portal (ISNP):
This will be the landing Web page for the whole system.
- ISNP Data Sensing (IDS):

IDS detects behaviours of user input, external sensor input from external components and social network activities. Apart from identifying and validating the these behaviours it also stores and dispenses the pre-processed data flows to the expected components so that other components within the back end can always get the right input.

- Water Use Visualizer (WUV):

It performs the visualisation features which enable the system to present the water use patterns in different media forms such as charts, histograms from different dimensions such as temporal, spatial, activity or even cost based.

- Water Use Pattern Visualization (WUPV)

This is front end component handles information from WUV.

3.1.1. Process Model

Below we display (in the form of a sequence diagram) the process model of the cluster of interactions named "Social Network Activity and Water Use Visualization". It is presented in a UML Sequence Diagram, where the main components are shown in their box, and the interactions are the arrows that travel between them.

At current implementation, we have enable the new user registration, post/reply and water use diagram request processes.
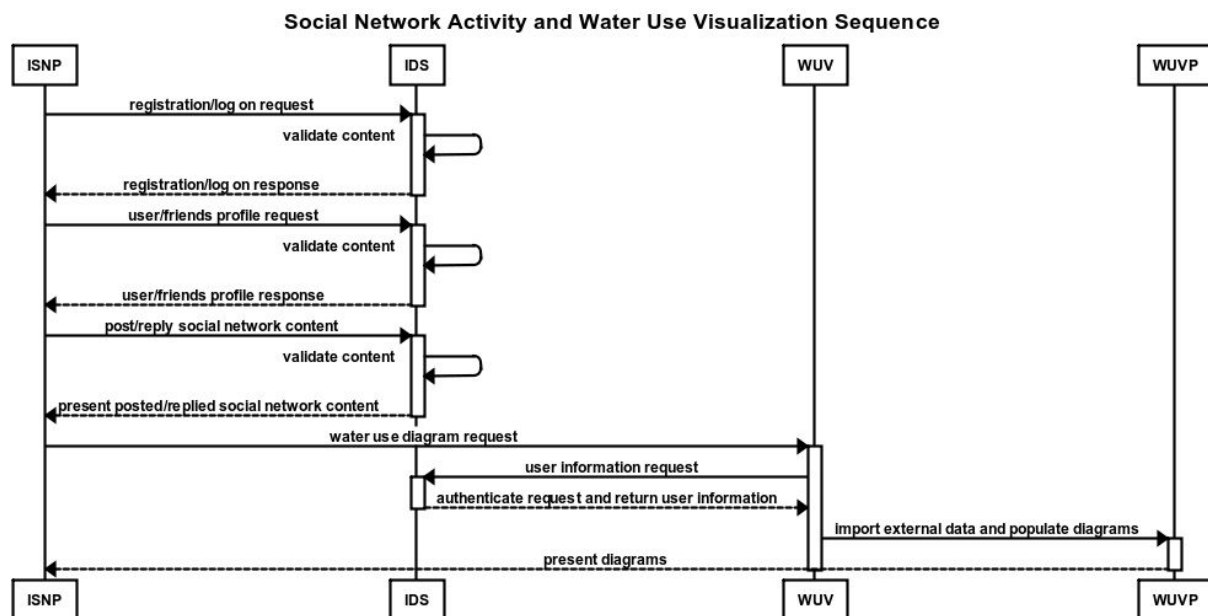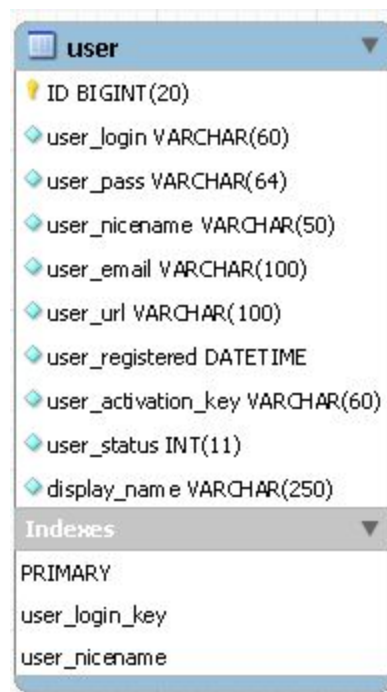
Figure 2 Process model for social network activity and water use visualisation

3.1.2. Data Model

There are mainly **three** types of data used in this module for different social network activities and user access control data exchange.

1. user: contains user information that comprises the **use profile**
2. posts: defined as a **base data structure** used to be extended and implemented **to define user input** and other **component data input** to SMP
3. postmeta: used to define the **additional data fields** in forms of key-value pairs of an extended posts type

Figure 3 shows the user data structure.

Figure 3 user type data structure

Figure 4 and Figure 5 show the posts type and post meta data type data structures.

Figure 4 posts type data structure

Figure 5 post meta data structure

3.1.3. Deployment Status

The fundamental feature of the social network activity and water use visualisation has been implemented, and deployed on an Apache server.

The current prototype supports the following social network interactions:

- *User profile management,* which supports uploading user images, password, personal information creation and update.
- *User relationship management*, which supports friends relationship, group membership creation and update.
- *User activity share and management,* which supports text, image and video sharing and reply.
- *Topic discussion*, which supports topic creation and reply.
- Questions and Answers (Q&As), which supports answer rating.

The water use data visualisation is currently supported via:

- Importing and parsing data from **external sources** such as google sheet data
- Receiving and storing data from **user input**

All future extensions of the Social network activity and water use visualisation will be part of the release schedule that is currently being planned for all development work in ISS-EWATUS in 2015.

3.2.   Gamification

The gamification mechanism puts the whole SMP in a game context, which involves the *user task management* and the *task achievement management*. The user tasks can be any social network activities, but also any water use related offline activities. Each of these user tasks can be rewarded upon the accomplishment. The gamification mechanism provided here allows managers to design user tasks and to reward points/badges as the user task progresses. The components involved include:

- Reward Store (RS):

It plays a pivotal role to incentivise the users participating in the whole system. The features of RS include calculation of rewards such as points, experience level, ranking etc. for each gamified social network activity. RS outputs the rewarding results in the forms of a leaderboard of regional users and of the notifications of rewards on an individual basis.

- Gamification Content Presenter (GCP):

This is front end component handles information from RS.

3.2.1. Process Model

The gamification process involves user task design, task status check and rewarding procedures (see Figure 6).
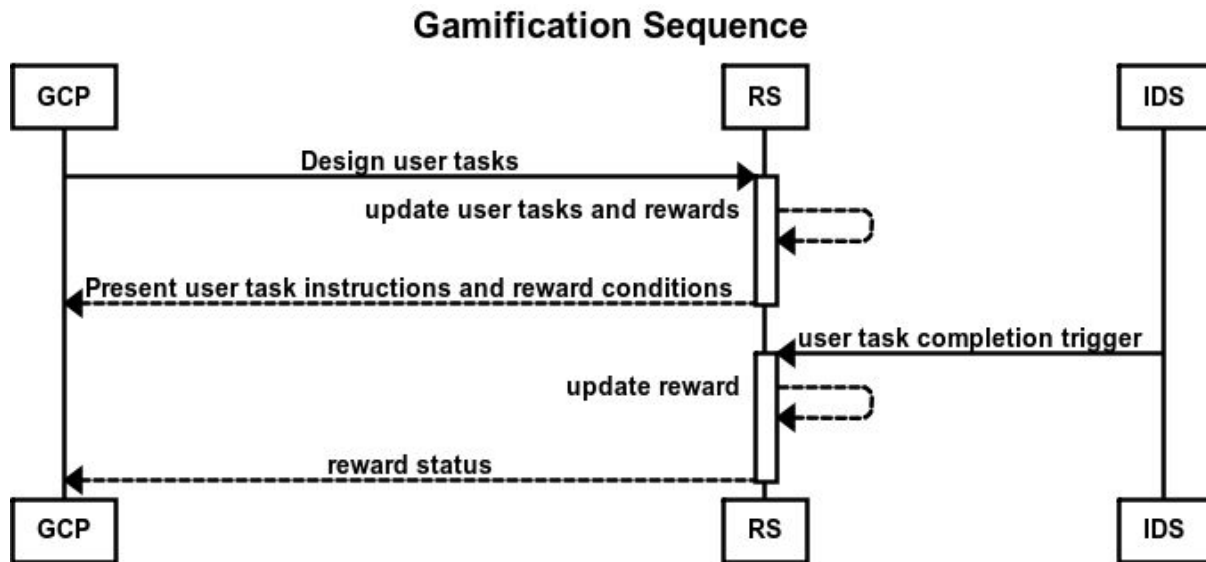
Figure 6 Process model for gamification

3.2.2. Data Model

The user tasks are defined by extending the abstract post type by defining additional data fields in the meta post type defined in Figure 5, the following table shows the **meta_key** used to design a user task (see Table 2).

Meta_key	Descriptions
singular_name	Task name singular form
plural_name	Task name plural form
points	Points to be awarded
earned_by	User ids for those finished the task and earned the points
points_required	Minimum points required to take part
congratulations_text	Congratulation texts
trigger_type	Triggering condition in terms of a user event such as login event
achievement_type	Achievement type,
maximum_earnings	Total points allowed for each user from this task
show_earners	Whether to show earners of this task
awarded_points	Total points awarded from this task

Table 2 key value pairs for user task post type

In order to allow users to keep a record of his/her achievements, we also extend the user type by
defining a meta user data structure (see Figure 7).

Figure 7 user meta data structure

And based upon the user meta data structure we defined additional data fields for a user profile as
below (see Table 3)

	Descriptions
	Achievement ids, i.e. task ids
ents	Tasks in progress, they will be task ids
	Total points earned

Table 3 key value pairs for user data structure in terms of gamification

3.2.3. Deployment Status

RS is now deployed on the Apache server. The current prototype supports the following
gamification features:

- Allow a manager to design user tasks such as input water use data from a Web page as a
  challenge in order to obtain a reward
- Allow a manager to assign points to challenges
- Allow systems to log each rewarding transactions and can be viewed from system admin UI

All future extensions of the gamification features, including the mobile app (**see Appendix C**), will
be part of the release schedule that is currently being planned for all development work in
ISS-EWATUS in 2015.

3.3. Evaluation

Evaluation allows managers and researchers to continuously monitor and get the statistics of users,
social network activities and user tasks and rewards information. There are two components
designed to handle these tasks, namely:

- Evaluation support (ES):

ES is the component serves dashboard, it collects data from RS and IDS so that it can produces a summative results of rewarding and all other social network activities occurred. ES performs different statistical features to produce the meaningful results.

- ISNP Dashboard (ID):

This is a Web based application that presents the results generated from ES based upon a user's privilege.

3.3.1. Process Model

The evaluation support process is shown below (see Figure 8) which involves data request call to the IDS and RS.
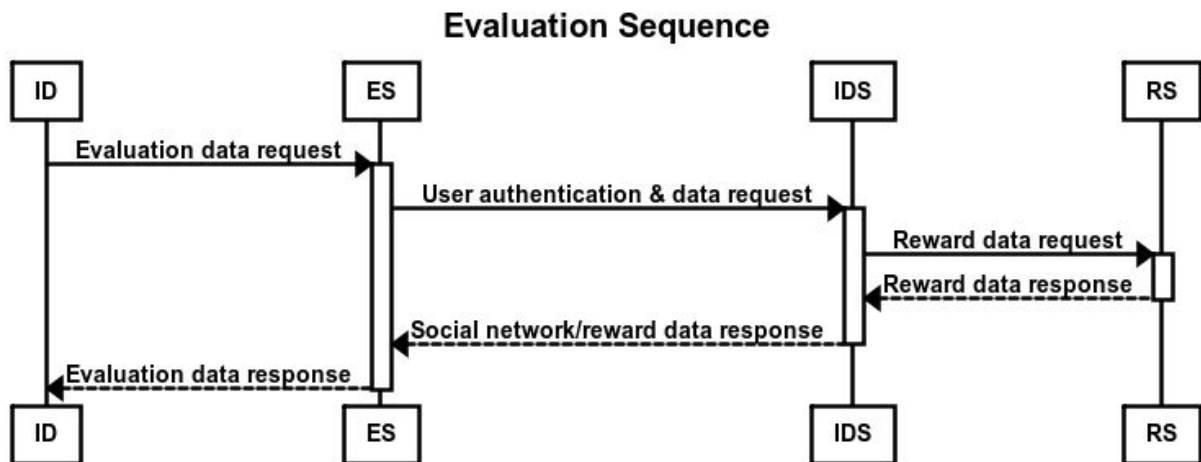
Figure 8 Process model for evaluation support

3.3.2. Data Model

The data model for ES is dependent on data defined in section 3.1.2 and 3.2.2. As of month 16, we have not defined any further data structure used by ES but we defined the APIs that can be used by ES in the next few releases.

3.3.3. Deployment Status

The fundamental feature supporting ES is now deployed on the Apache server.

The current prototype supports the ES with the following features:

- Retrieving user information from IDS GET users API
- Retrieving post information from IDS GET posts API

- Creating evaluation data from IDS POST posts API

All the future extensions of the gamification features will be part of the release schedule that is currently being planned for all development work in ISS-EWATUS in 2015.

4.   Appendix A: SMP Release Agenda

As planned in the Task 5.3, the SMP takes an iterative will be based on a modular architecture, where existing components will be composed and integrated into a new software system. The development of the social-media platform will be based on an iterative and incremental development, where prototypes will be developed and delivered as long as they become available. A release plan is presented in Table 4.

Release	Objectives	Planned Development Duration	Status
R0	• User access control • Social network activities support	Month 12-14	Completed
R1	• Richer social network activity • Data visualisation support • Rewarding service	Month 15-17	In progress
R2	• Gamification (including mobile gamification app in Appendix C) • Water use user input	Month 18-20	In progress
R3	• Evaluation support service	Month 21-22	In progress
R4	• Localisation and Web site theme styling	Month 23-24	In progress

Table 4 SMP release plan
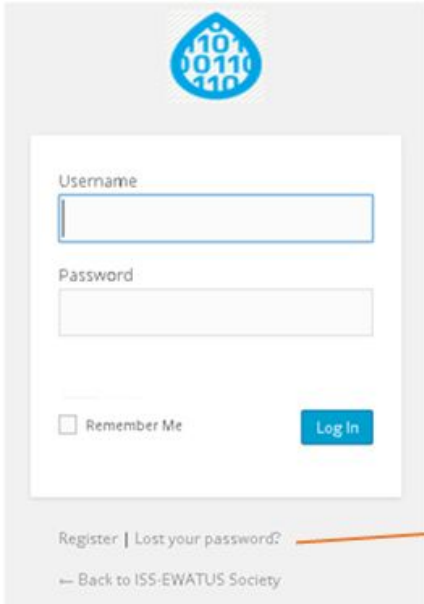
5.   Appendix B: User Guide for SMP R0 GUI

This section provides the user guide for the release 0. There is also an online version which is available at

https://bitbucket.org/issewatuswp5/social-media-platform/wiki/Releases

5.1.   User Login

Figure 9: the user login options, where the user can choose to register, log in or ask the system to resend the password.

Figure 9 user log in page

5.2. Registration Form

Figure 10 Landing page: the user will need to fill in all the required fields in this form to complete the standard user registration to have an access to the platform (there will be other registration options available in the future release)

Figure 10 user registration page

5.3.   Activity Page

Figure 11: The landing page shows the recent activities of the different types of communities, there are also user profile, message notification control panel for the current user.
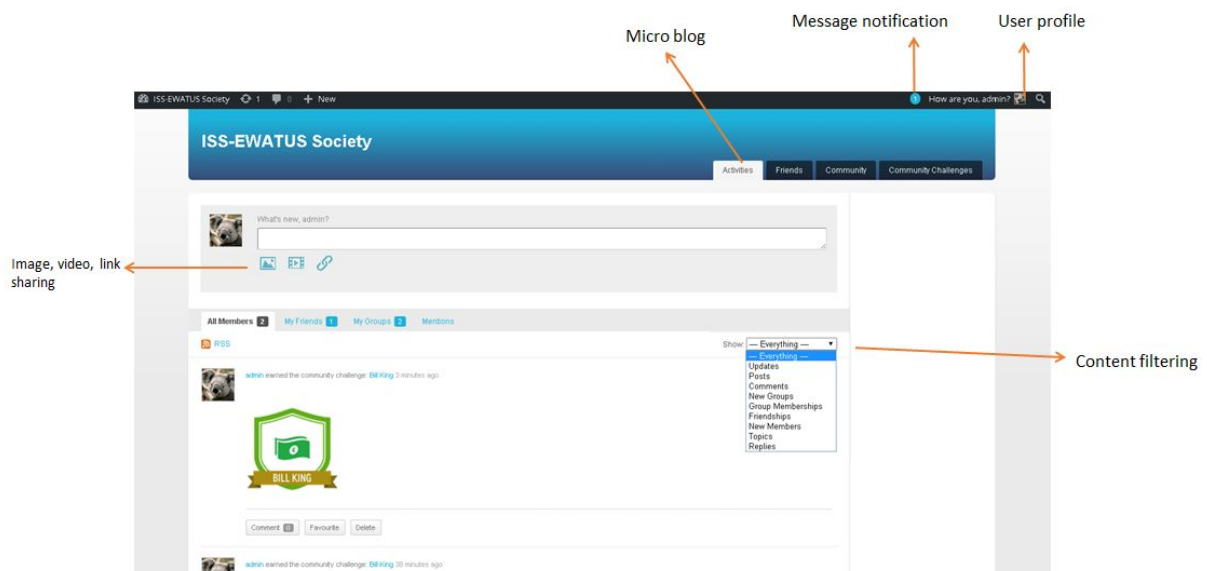
Figure 11 activity page

5.4. Friends Page

Figure 12: the friends' page shows the current user's friends and also allows the current user to manage the relationships with his/her friends. There is also a shortcut control panel allowing the current user to manage his/her own activities/topics/replies.

Figure 12 friends page

5.5. Community Page

Figure 13: the community page shows the current user groups within the ISS-EWATUS social media platform.
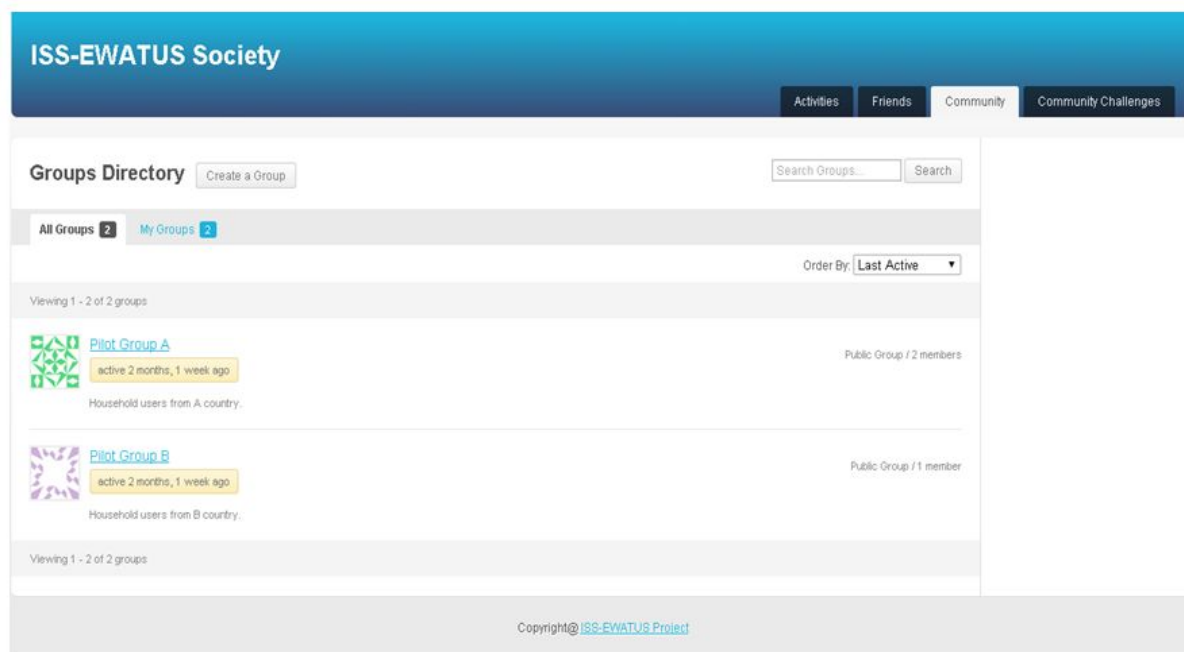
Figure 13 community page

5.6. Forums

Figure 14: the forums page allows users to browse for topics and start new topics

Figure 14 forum page

5.7.   Community Challenges

Figure 15: The community challenges allow user to earn points after completing the designed tasks

Figure 15 community challenges, a.k.a user tasks

5.8.   User Management

Figure 16: Administrator users can manage users in the admin dashboard
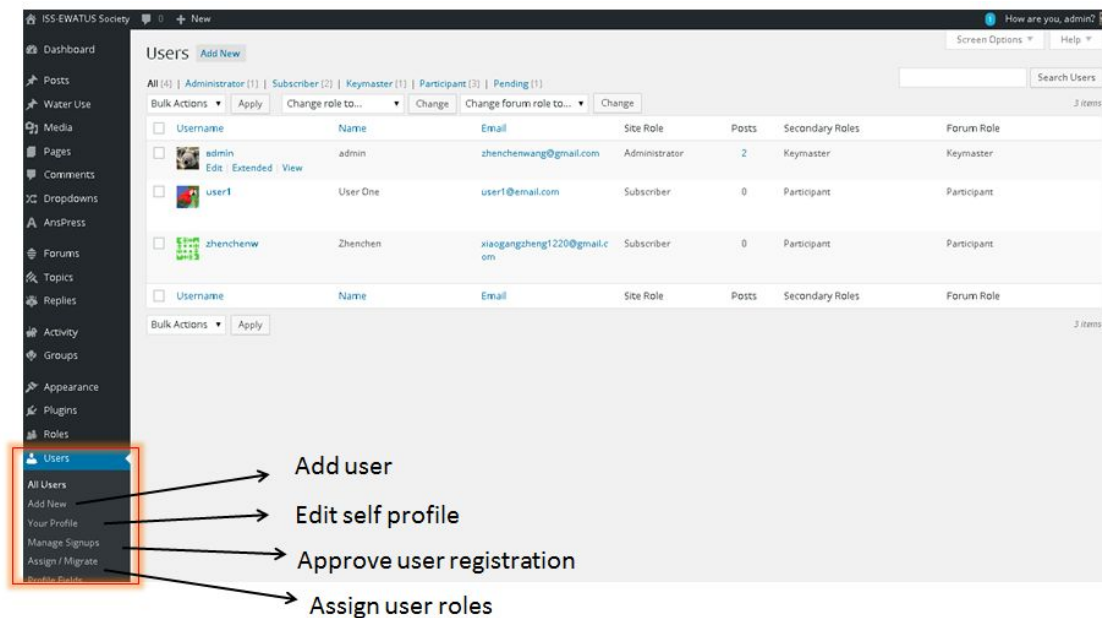
Figure 16 user management

5.9.   Forum Topics Management

Figure 17: Administrator users can also trace, modify and update all the topics of the platform in admin mode (i.e., dashboard)
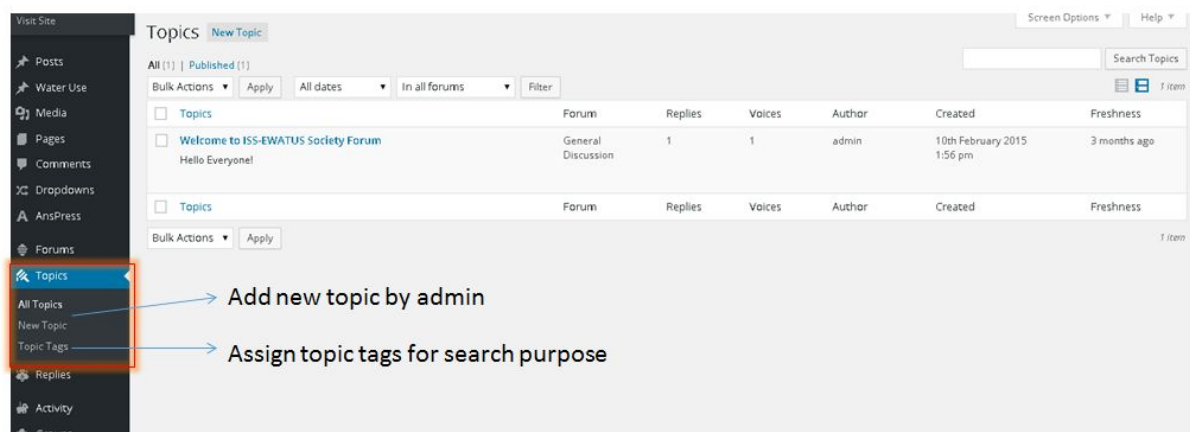
Figure 17 forum topic management

5.10. Activity & Reply Management

Figure 18: Administrator user can trace all activities in admin mode

Figure 19: Administrator user can trace a reply from replies menu in admin mode
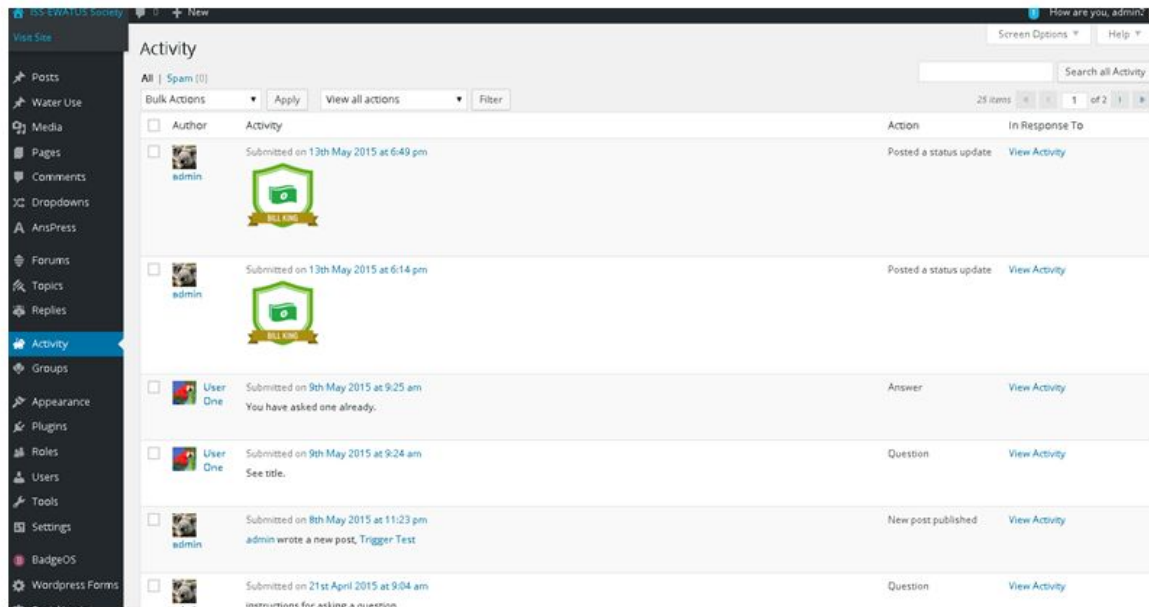
Figure 18 tracing activities
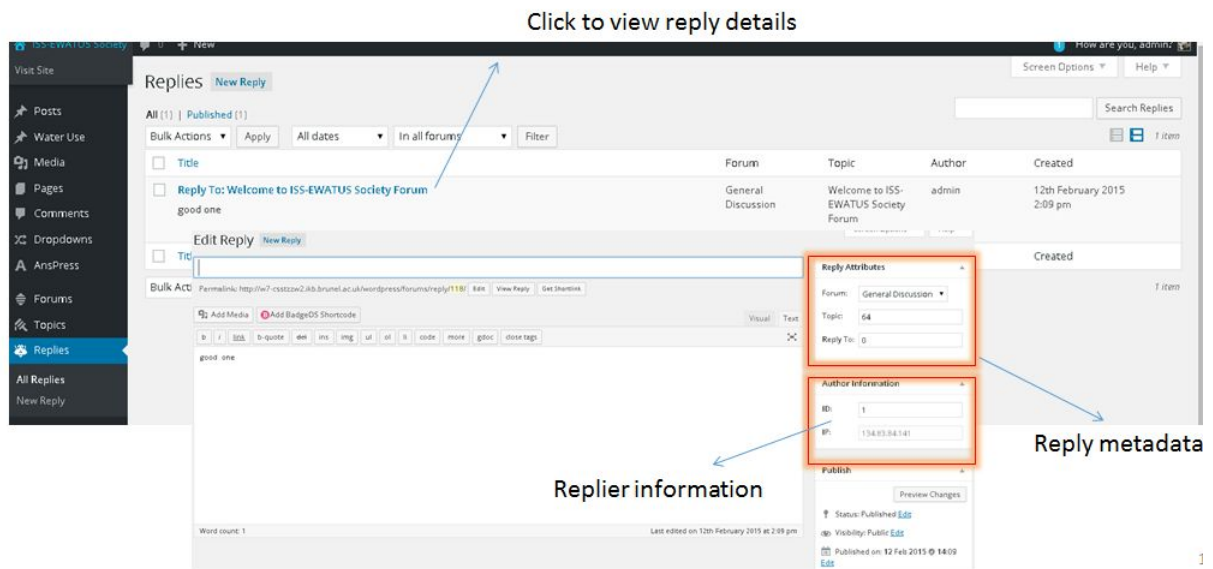
Figure 19 tracing replies

5.11. Sending Messages

Admin users can send messages to all users while normal users can send messages to his or her friends (see Figure 20).
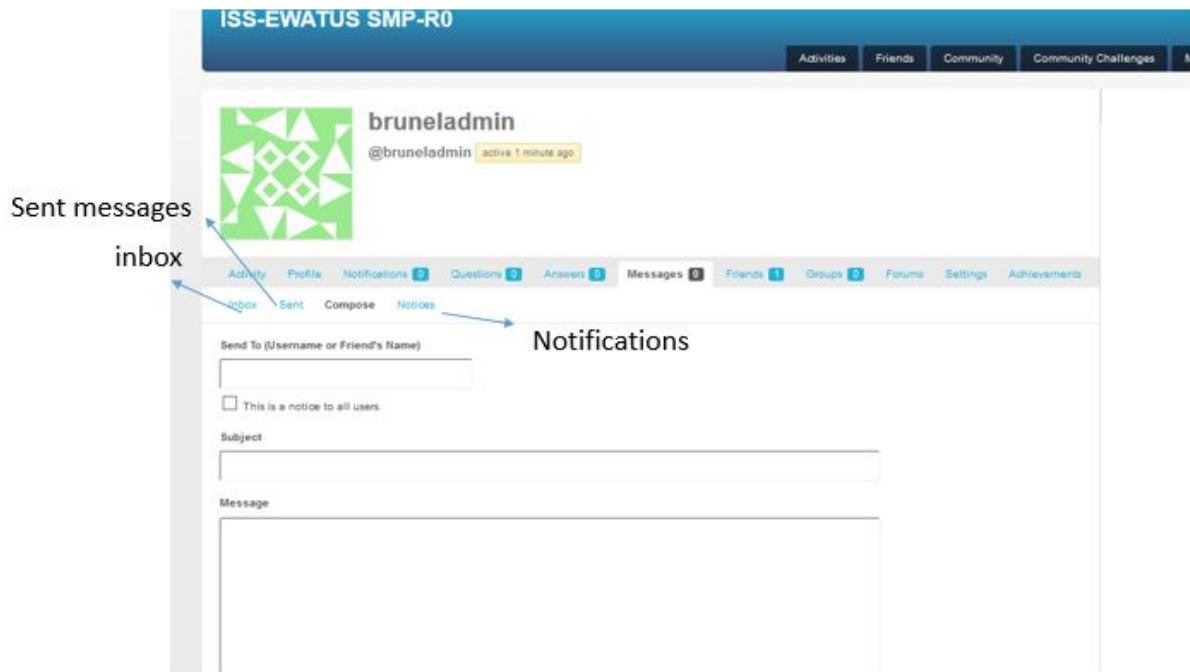
Figure 20 Sending message page

6.   Appendix C: EGA (EWATUS Gamification Application) Design

In order to increase the user participation and engagement in the SMP, the consortium decided to build a mobile application (EWATUS Gamification Application - EGA). The EGA can act as an educational social game, allowing users to take part in quests and performing tasks of varying difficulty. The objectives are

1. the minimization of water consumption in their household / municipality,

2. the reduction on the household water bill and

3. the awareness of the users on water preservation.

The Gamification app presented in this section is a mobile version of the GCP and RS components (**see Gamification 2.2**). Apart from the app's internal business logic and data processing, the EGA will follow the same process model and use the APIs of the RS component to communicate with the central SMP.

The vision for the EGA is to enable household users to participate in various **quests**, consisting of several **tasks**. Tasks can vary from (i) uploading household water consumption data, (ii) viewing and sharing water consumption statistics, (iii) joining or competing with others users (friends or not), (iv) posting small videos of themselves washing the dishes or brushing their teeth etc. The

completion of each task awards users with points and water consumption ratings (achievements) which are transferred to a leaderboard where users can view their position compared to their friends and realize who is the "eco-Gardener" or the "water consuming Skroutz" or various other achievements which will be awarded to them upon the completion of specific quests or tasks.

Points awarded from activities in the EGA will be transferred to the social network which will maintain the user profile centrally. Users will be awarded points for activities in both mobile applications and SMP, thus increasing the recognizability within the EWATUS ecosystem.

The EGA also enables water authorities to (i) gather water consumption data from households, (ii) get information on users' water preservation awareness activities, (iii) make suggestions and user-targeted advice on water consumption, and (iv) promote water-saving campaigns from the respective quests/tasks that will be setup in the EGA.

6.1. EGA Architecture

The prototype EGA application was built based on web technologies (HTML5/Javascript). In order to be deployed onto mobile devices, the code was wrapped via PhoneGap to produce native Android and iPhone applications. The choice of PhoneGap for the prototype was made to accelerate development and to be able to quickly build and ship the app on multiple platforms.
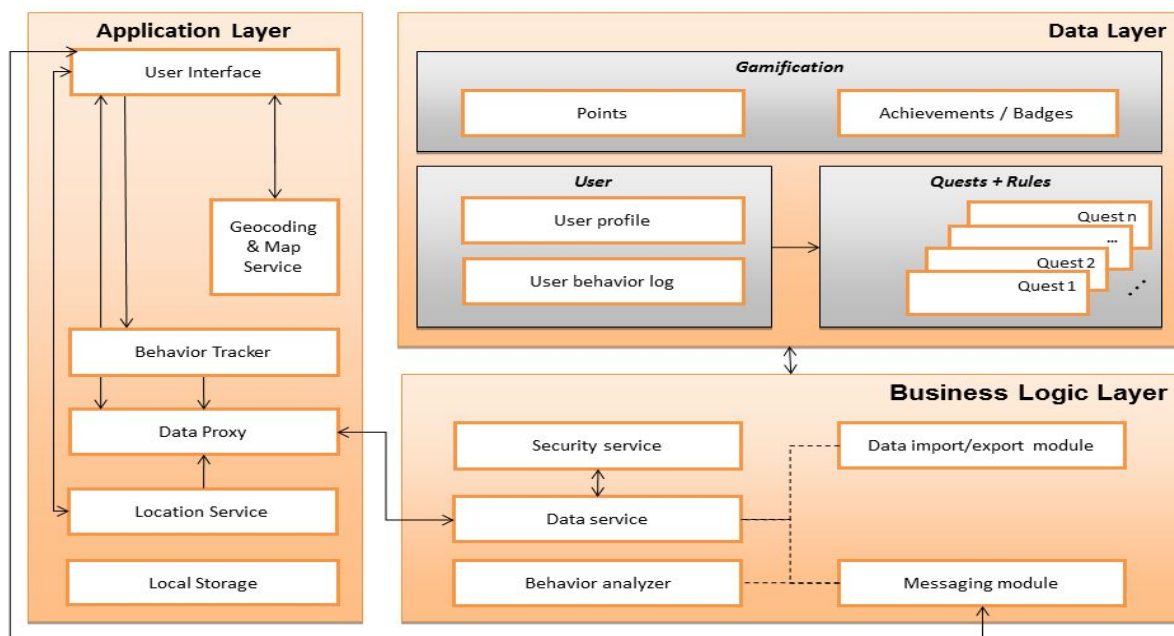
Figure 21 EGA Architecture

The different EGA architecture layers are detailed in the sections below:

Data & storage layer – this layer contains the user profiles with the associated descriptive information (e.g. the users characteristics, age etc.), as well as a detailed audit of their actions in the EGA app. Quest-related data is saved in this layer, and containing the essential rules (e.g., the tasks that the user has to accomplish), the user activity data for each quest and the geographical related information which is essential in order to improve the EGA user experience. Leaderboards with points that users have accumulated in each quest are also stored here.

Business logic layer – this layer responds to requests that follow the application logic and passing the appropriate content, securely, to the client application (as defined below in the "application layer"). This communication will be achieved via a Restful API which can be accessed through the http protocol, and WebSockets.

The API handles the requests and data exchange with third party services and the data layer in order to provide a uniform interface to the clients. This layer's services will perform logic procedures like:

- Identity management, authentication, and authorization to allow data access only to authorized users;
- Creation of alert notifications, according to the user's preferences or actions via the Notification and Pub/Sub Messaging module
- Filter and serve data according to user location, groups of interest, etc. and also act as a proxy to synchronize data push/requests to/from the applications in the application layer (Data Service).
- User behaviour analyser module will analyse user's actions collected by the front end applications and push certain actions back to the application layer via http requests in order to better suit the application to the user needs.

The **Application Layer** hosts the user's interaction interface which will be available as a mobile application. This layer will offer full end-user access to all EGA services. Via the EGA, the mobile users will participate in the quests that have been predefined for them and provide valuable behaviour tracking data through the use of the app to the administrator that is monitoring them. A number of client (frontend) services will be interacting in this layer, using data that Business Logic (server side) layer will be providing and also providing data back to it. Such services are:

- User's **interaction logging** (via the *Behaviour tracker* module) will observe user's interplay and forward certain actions to business layer via http requests.
- Validation of a user's **GPS location** when participating in geographic related quests (via the *Location Service* module).
- Geocoding and map data representations (via the *Geocoding & Map Service* module) will be used via Google Maps.

● A **Data Proxy** that will answer requests for storing and retrieval of quest data even in the case network connection is temporarily unavailable. Therefore the proxy will be able to synchronize only quests relevant to the user based on spatial, temporal, and user-preference criteria.

● Temporary user's data storage (via the *Local Storage* module). In order to reduce the user's required actions, some data related to user and his/hers behaviour will be stored in user's device and it will be used repetitive.

6.2. EGA interfaces and feature

The initial EGA screen (once a user has connected with their credentials to the application) presents the user with a summary of the available quests and the ones that they have joined or not completed yet.

For those quests that the users have already started, but not completed, a completion percentage is visible within the summary page. Furthermore, the quests including a distinctive ribbon in the upper right corner with the word "Reward" will be converted in real life rewards (see Figure 22).

When clicking on one of the quests, the user is presented with all the tasks that compose the quest. At the top of the screen, a progress bar indicates the user's current completion percentage of the quest. If the user has already joined the quest, the tasks yet to be completed are presented first, followed by the ones that he has already completed. The competed tasks are marked with a green colour and present additional information about the points earned (Figure 15).
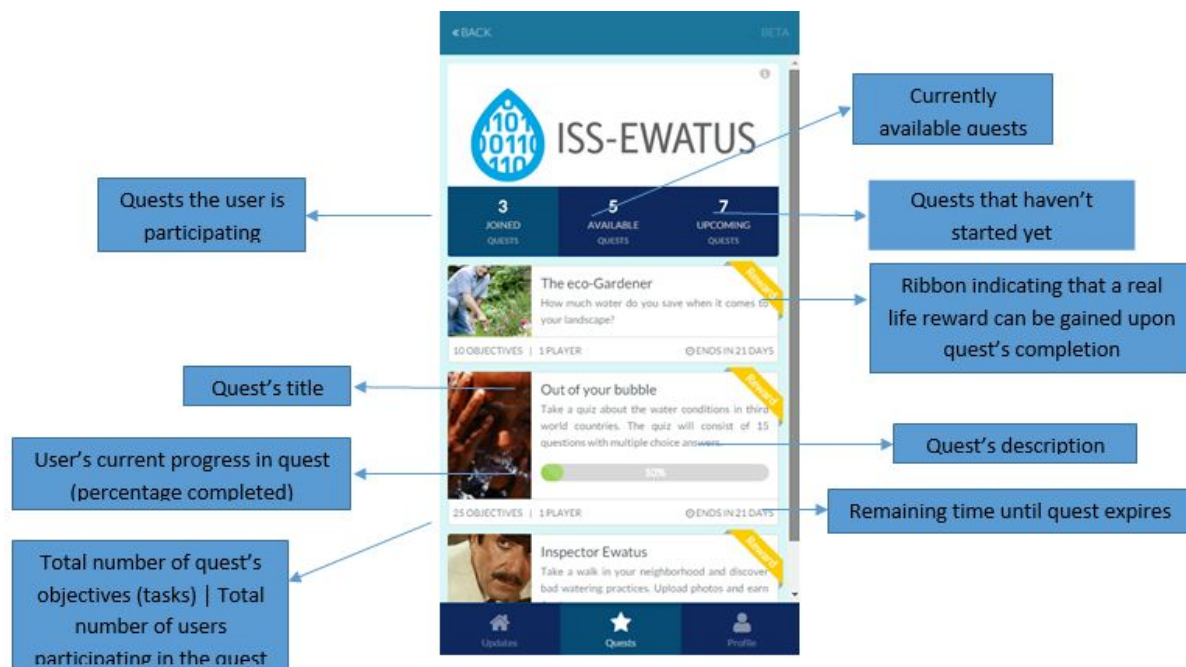
Figure 22 - The EGA starting screen
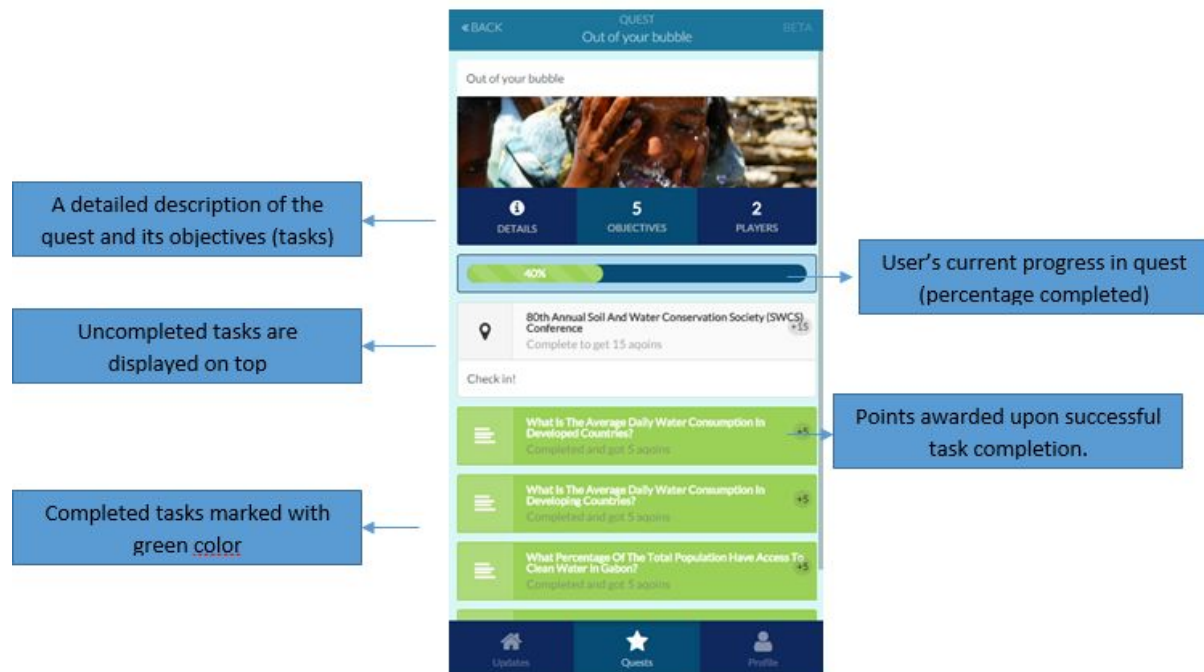
Figure 23 - Quest objectives (tasks)

6.2.1.1. Integration with existing social networks

Users can connect their Facebook and Twitter social accounts to the EGA and choose to publish on those platforms the actions that they perform in the EGA. When the completion of a task is published to a user's personal social network account, users are automatically awarded with extra points. Furthermore their friends are informed and challenged to join and compete with them in the EGA and the EWATUS social network. The EGA users will also be able to publish their actions to their friends in the EWATUS social network apart from the aforementioned social networks.

6.2.1.2. Quests and tasks

The EGA can have a number of quests depending on the purpose that each quest intends to serve. Quests were designed to be dynamic, and organisations (e.g. water companies) will be able to create their own quests. Some quests might be built to serve educational purposes while others will require users to perform certain tasks in order to fulfil another purpose (e.g. collect best practices, or improve water usage habits).

This project has received funding from the European Union's Seventh Framework
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Each quest can consist of a series of tasks (Figure 24) which equire either the use of a player's mobile phone capabilities (GPS, Camera, Microphone, NFC, etc.) or the use of a third party service (Facebook, Twitter, etc.). The Quest Master (QM) can set a time limit or a time frame (e.g. from / to date) for each Quest. The Quest Master can be a water authority or a user who has the highest level of water-consumption awareness and has been approved by a water authority. Whenever users accomplish a task, they are awarded with points.

A task can have a number of restrictions

- **Time** limited (e.g. you have 2 days to upload a picture of your water meter reading)
- **Location** limited (e.g. only for Players belonging to a certain municipality)
- A **combination** of the above (e.g. upload a photo from a water leakage in your municipality in the next month)

A task (see Figure 25 to Figure 29) can require the user to perform various mini-missions depending on the quest. Such examples are:

- Take a picture of something (e.g. water meter)
- Take a video of some action (e.g. use brushes teeth or washes dishes)
- Solve a riddle by completing a missing word (numeric most probably)
- Solve a riddle by picking among 4 options
- Like a Facebook page (in order to increase engagement)
- Post a photo (Facebook, twitter, EWATUS social network)
- Post something (Facebook, twitter, EWATUS social network)
- Post a URL (Facebook, twitter, EWATUS social network)
- Write something (free text)
- Gather more retweets of a tweet with a specific hashtag
- Be the first to check in to a place

Figure 24 - A Quest's screen
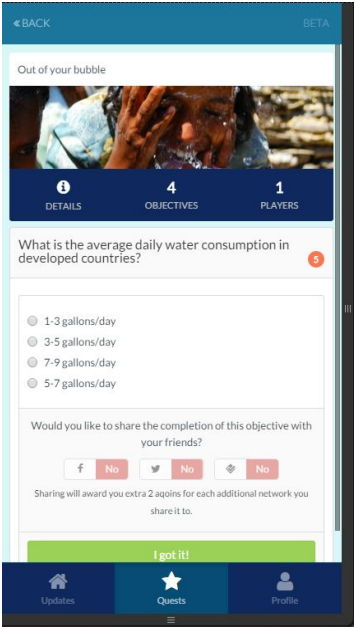
Figure 25 – Multiple choice task
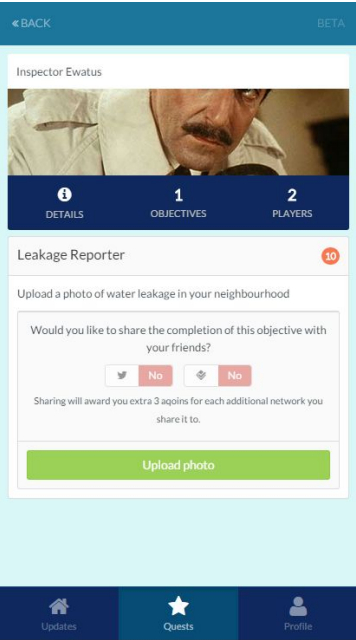
Figure 26 - Upload photo task
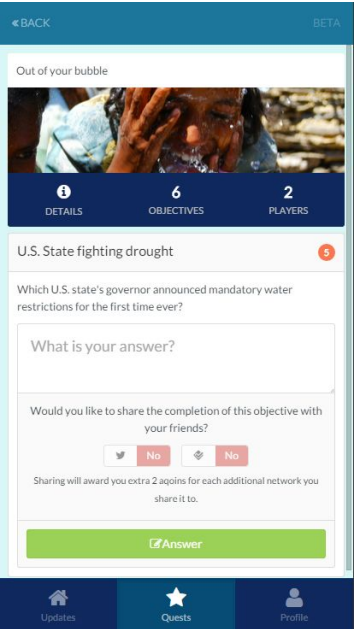
Figure 27 – Fill in correct answer task
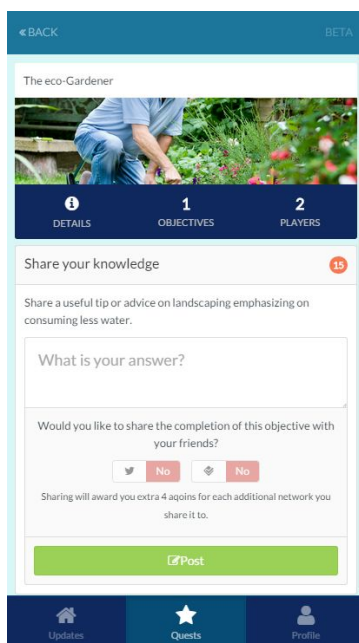
Figure 28 - Free text task
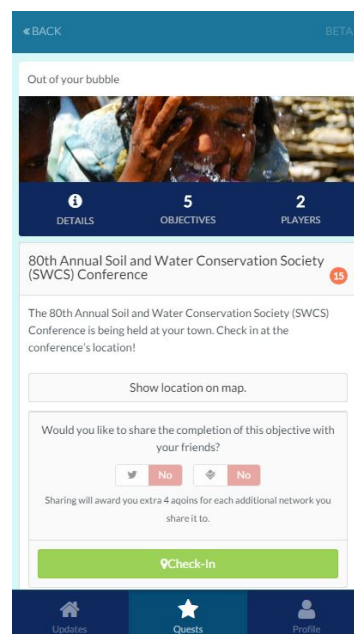
Figure 29 – Check in to a place task

6.2.1.3. Badges
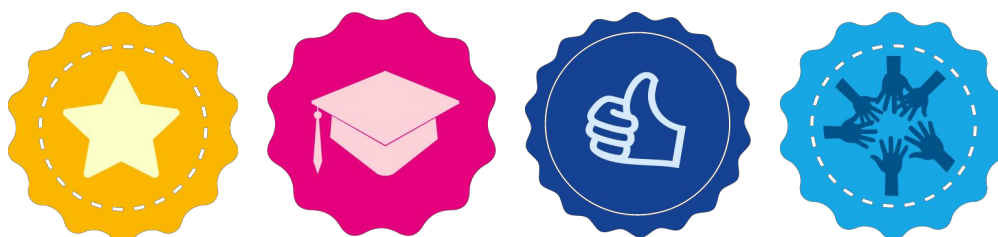
The above badges are indicative.

Apart from earning points, players can also earn badges upon a task completion. Badges are displayed on the user's profile and indicate his level of experience / participation in the app.

6.2.1.4. Leaderboards

Each quest in EGA has its own leaderboard (Figure 30) where users can see how all players participating in that quest are doing. As participation increases and players complete more tasks in the quest, they are awarded with more points changing the leaderboard balances. The leaderboard can become a more competitive place when a Quest has a real life reward, apart from the virtual ones which are points (called Aqoins - Figure 31), badges and achievements. Such options are given by the EGA to the Quest organizer.
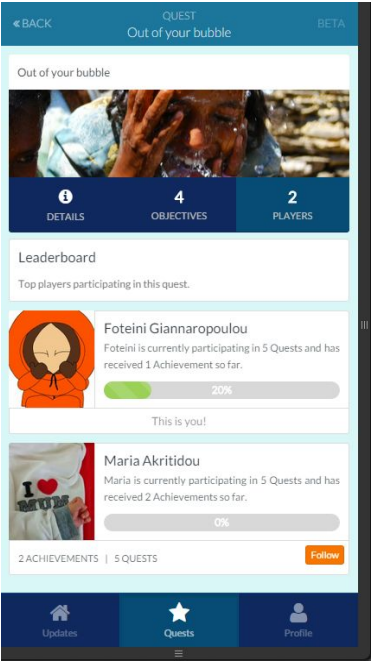
Figure 30 - Leaderboard
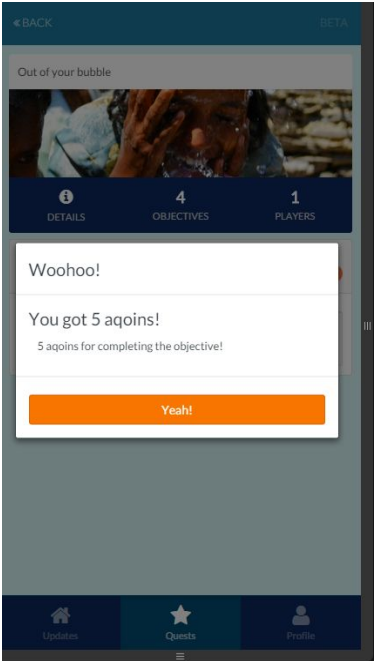
Figure 31 – Five Aqoins (points) awarded for the
completion of a task

6.2.2. EGA quest scenarios

6.2.2.1. Assumptions

- All quests are repetitive
- Competitive quests can be run on a general or municipal level

6.2.2.2. Quest Scenario 1: Track your water consumption

This particular quest will give players the chance to increase (or decrease) their rankings. Increasing or decreasing one's ranking is decided upon a combination of ratings from other players, stakeholders, goals achieved and players' water usage statistics over time. Badges (earned from other quests) can also be a booster of one's ranking.

Municipality: Only own

Task #1	Upload water usage data (optionally automated task with the use of smart meters)
Small Description	Upload daily water usage data
Description	Upload water usage data every day. Data is available in different categories: ● WG: water gradient ● WC: water consumption ● WP: water pressure ● WL: leakage *This quest could be revised depending on whether this will be an automated procedure or not. In the second case maybe it would be user friendlier to upload water usage data monthly or weekly.*
Outcome	View graphs of household's water usage over time. Watch your progress over time. Compare results with other players of the same municipality. View the visualized results of the collected data of water consumption in street-, borough- and city-level of "above-average, average, and below-average" consumption of water
Achievements	Earn points!

Task #2	Be a team player!

Small Description	Share your water usage data statistics with other players
Description	Share your water usage data statistics with other players in your municipality.
Outcome	Earn the right to rate other players in your municipality.
Achievements	Earn points!

Task #3	Foot the bill!
Small Description	Upload your water bill.
Description	Upload your water bill.
Outcome	Get personalized advices on your water consumption against water charges and on how to better plan your household maintenance budget by changing your water consumption behaviour. (Could include suggestions on further quests to take as well) Earn the right to view anonymous water charging statistics of other players in your municipality.
Achievements	Earn points!

Task #4	Set your goal!
Small Description	Set a goal on your next month's water bill
Description	Define a maximum value for your next month's bill total price
Outcome	Reduce your water bill.
Achievements	Earn more points by achieving your goal!

6.2.2.3. Quest Scenario 2: Out of your bubble

Task #1	Are you aware of the third water countries water problems?

Small Description	Take a quiz about the water conditions in third world countries.
Description	Watch an educational video and take a quiz about the water conditions in third world countries. The quiz will consist of 10-15 questions with multiple choice answers.
Outcome	Get informed about water conditions in the third world countries and become aware of your advantages.
Achievements	We feel you should do this for yourself so no points or badges here!

Task #2	The 80th Annual Soil and Water Conservation Society (SWCS) Conference.
Small Description	The 80th Annual Soil and Water Conservation Society (SWCS) Conference is being held at your town. Check in at the conference's location!
Description	The 80th Annual Soil and Water Conservation Society (SWCS) Conference is being held at your town. Check in at the conference's location!
Outcome	Gain science-based knowledge on critical, current issues facing soil, water, and environmental sustainability.
Achievements	Earn points!

Task #3	Take a pledge!
Small Description	Take a water preservation related pledge!
Description	Take a pledge to water only at night or in morning, or run only full loads of laundry or dishes or repair leaky faucets etc. When you take a pledge it is automatically announced publically in your connected social media accounts.
Outcome	Change your water spending routines and encourage others to follow your example!
Achievements	Earn points!

6.2.2.4. Quest Scenario 3: Inspector Ewatus

Task #1	Leakage Reporter
Small Description	Upload a photo of water leakages in your municipality

Description	Take a walk in your neighborhood and discover water leakages. Take and upload photos proving those leakages exist.
Outcome	Help your local Water Authorities reduce leakages in your municipality.
Achievements	Earn points!

Task #2	Best practices investigator
Small Description	Take a video proving bad watering practices in your neighborhood. Upload it on YouTube and paste the link!
Description	Take a walk in your neighborhood and discover bad watering practices. Upload a video displaying those practices.
Outcome	Help your local Water Authorities discover bad watering practices in your municipality.
Achievements	Earn points!

6.2.2.5. Quest Scenario 4: The eco-Gardener

Task #1	The eco-Gardener quiz!
Small Description	How much water do you save when it comes to your landscape?
Description	Answer a series of multiple choice questions about your gardening habits.
Outcome	Find out if your gardening habits are water preservative. Get tips and tricks to improve your water preservation gardening behaviour. (e.g. fill a bucket while your shower and empty in your garden) Earn the right to upload and share photos of your landscape (**Task #2**).
Achievements	Earn points!

Task #2	The apples of your eyes!
Small Description	Take photos of your landscape
Description	Upload and share photos of your landscape.
Outcome	Earn the right to rate other players' landscape photos (**Task #3**).

Achievements	Earn points!

Task #3	Share your knowledge
Small Description	Share a useful tip or advice on landscaping.
Description	Share a useful tip or advice on landscaping emphasizing on consuming less water.
Achievements	Earn points!

Task #4	The social gardener!
Small Description	Take another quiz on gardening tips and advice shared by other players
Description	This quiz consists of multiple choice questions related to other players' tips and advice from task #3.
Outcome	Get the chance to learn useful tips and ideas on water preserving landscapes.
Achievements	Earn points!

Task #5	Landscape of the month!
Small Description	Rate other players' landscapes
Description	Rate other players' landscapes, based on the photos they've uploaded and the eco-Gardener quiz results
Achievements	The Landscape of the month winner wins the **gardener of the month** badge. You have the most beautiful garden and now everyone will know it!

6.2.2.6. Quest Scenario 5: The Campaign

Task #1	The godfather
Small Description	Propose a name and subject for this month's Water Preservation Campaign for your municipality

Description	Propose a name and subject for this month's Water Preservation Campaign for your municipality
Achievements	Earn points!

Task #2	The artist
Small Description	Upload a banner for this month's Water Preservation Campaign for your municipality
Description	Upload a banner for this month's Water Preservation Campaign for your municipality
Achievements	Earn points!

Task #3	The manager
Small Description	Fill in a weekly calendar with proposed events for this month's Water Preservation Campaign for your municipality
Description	Fill in a weekly calendar with proposed events for this month's Water Preservation Campaign for your municipality
Achievements	Earn points!

Task #4	The voting
Small Description	Vote the best name, subject and calendar among the ones submitted from players in your municipality.
Description	Vote the best name, subject and calendar among the ones submitted from players in your municipality.
Achievements	Earn points!

Task #5	The social media guru
Small Description	The campaign is set up. Promote it!
Description	The campaign is set up. Share it! Tweet about it! Promote it in social media!
Achievements	Earn points!

Task #6	The final voting!
Small Description	Vote the best campaign among participating municipalities.
Description	Vote the best campaign among participating municipalities.
Outcome	The best campaign will be run from the corresponding municipal water authorities!
Achievements	Earn points!

7.   Appendix D: API Documentation

This section documents the APIs used for consuming the developed components. These APIs can be mapped in Figure 1.

7.1.   IDS APIs

The INSP and IDS components will expose a set of open APIs by using Restful Web services. This will allow the SMP to be flexibly integrated with heterogeneous systems including Android and/or iOS apps. Below we document the APIs in a standard format, with the type of method, and the inputs and outputs (if any).

URL	Method	Description	Input JSON body	Output
/wp-json/users	POST	Create a user	{"username":"newuser"," name":"New User","password":"secret "}	Code 201 for success or 403 for not authenticated
/wp-json/users ?filter	GET	Retrieve a group of users	The filter parameter controls the query parameters. ● number - Number of users to retrieve, use -1 for all users. Default is set by the site. (integer) ● offset - Number of posts to skip. Default is 0. (integer) ● orderby - Parameter to search by, as per	User Collection document containing the requested Users if available. A 403 Forbidden status is returned if the client is not authenticated.

			WP_User_Query. Default is "user_login". (string) - order - Order to sort by. Default is "ASC". (string, "ASC" or "DESC") - s - Keyword to search for. (string)	
/wp-json/users/ {id}	GET	Retrieve a user	id is the integer The context parameter controls the format of the data to return.	The response is a User entity containing the requested User if available. The fields available on the User depend on the context parameter. A 403 Forbidden status is returned if the client is not authenticated.
/wp-json/users/ me	GET	Get current user		On a successful update, a 200 OK status is given, indicating the user has been updated. The updated User entity is returned in the body. If the client is not logged in, a 403 Forbidden status is given.
/wp-json/posts	POST	Create a post	{"title":"Hello World!","content_raw":"Content","excerpt_raw":"Excerpt"} The data parameter should be an object containing the following key value pairs: - ID - required - title - required - content_raw - required - excerpt_raw - optional - name - optional - status - optional - type - optional - date - optional - date_gmt - optional - author - optional - password - optional - post_parent - optional	On a successful creation, a 201 Created status is given, indicating that the post has been created. The post is available canonically from the URL specified in the Location header. The new Post entity is also returned in the body for convienience. If the client is not authenticated, a 403 Forbidden response is given.

			- post_format - optional - menu_order - optional - comment_status - optional - ping_status - optional - sticky optional - post_meta - optional	
/wp-json/posts ?type[]=topic	GET	Retrieve posts	Any registered post types, e.g. - posts - reply - topic - answer - quest - reply	The response is a Post Collection document containing the requested Posts if available.

Table 5 IDS APIs to manage users and manage posts

Example: User JSON form

```
1.  [
2.  {
3.  "ID": 1,
4.  "username": "admin",
5.  "name": "admin",
6.  "first_name": "admin",
7.  "last_name": "",
8.  "nickname": "admin",
9.  "URL": "",
10. "description": "",
11. "registered": "2014-09-30T15:47:33+01:00",
12. "email": false,
13. "meta": {
14. }
15. }
16. }
17. ]
```

Table 6 User in JSON form

Example: Post JSON form

```
1.  [
```

```
2.   {
3.     "ID": 349,
4.     "title": "Trigger Test",
5.     "status": "publish",
6.     "type": "post",
7.     "author": {
8.       "ID": 1,
9.       "username": "admin",
10.      "name": "admin",
11.      "first_name": "admin",
12.      "last_name": "",
13.      "nickname": "admin",
14.      "slug": "admin",
15.      "URL": "",
16.      "avatar": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-content\/uploads\/avatars\/1\/d92bdcb385f749d7bf9843bf16657975-bpfull2.jpg",
17.      "description": "",
18.      "registered": "2014-09-30T15:47:33+01:00",
19.      "meta": {
20.        "links": {
21.          "self": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/users\/1",
22.          "archives": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/users\/1\/posts"
23.        }
24.      }
25.    },
26.    "content": "",
27.    "parent": null,
28.    "link": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/trigger-test\/",
29.    "date": "2015-05-08T23:23:26",
30.    "modified": "2015-05-08T23:23:26",
31.    "format": "standard",
32.    "slug": "trigger-test",
33.    "guid": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/?p=349",
34.    "excerpt": null,
35.    "menu_order": 0,
36.    "comment_status": "closed",
37.    "ping_status": "open",
38.    "sticky": false,
39.    "date_tz": "Europe\/London",
40.    "date_gmt": "2015-05-08T22:23:26",
41.    "modified_tz": "Europe\/London",
42.    "modified_gmt": "2015-05-08T22:23:26",
43.    "password": "",
44.    "meta": {
45.      "links": {
```

46. "self": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/posts\/349",
47. "author": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/users\/1",
48. "collection": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/posts",
49. "replies":
    "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/posts\/349\/comments",
50. "version-history":
    "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/posts\/349\/revisions"
51. }
52. },
53. "featured_image": null,
54. "terms": {
55. "category": [
56. {
57. "ID": 1,
58. "name": "Uncategorised",
59. "slug": "uncategorised",
60. "description": "",
61. "taxonomy": "category",
62. "parent": null,
63. "count": 1,
64. "link": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/category\/uncategorised\/",
65. "meta": {
66. "links": {
67. "collection":
    "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/taxonomies\/category\/terms",
68. "self":
    "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/taxonomies\/category\/terms\/1
    "
69. }
70. }
71. }
72.]
73. }
74. }
75.]

Table 7 Post in JSON form

7.2. WUV APIs

There are two groups of WUV APIs, one is the set of APIs that is used to receive data from external components, at this stage, the APIs are used to receive data from the user input.

Data from users are mainly handled by a data collection from the user interface. In order to collect the data, a plugin is created to generate a new post type called wateruse. There are SMP data forms created for receiving the data inside the platform, it also allows user forms from other systems such as android apps to submit data to the platform using the following Web service

method. Note that the type must be "wateruse" and excerpt_raw must be the JSON form of "waterusetype" object.

URL	Method	Description	Input JSON body	Output
/wp-json/posts	POST	Create a post	{"title":"Hello World!","content_raw":"Content","excerpt_raw **waterusetype**"} The data parameter should be an object containing the following key value pairs: ● ID - required ● title - required ● content_raw - required ● excerpt_raw - optional ● name - optional ● status - optional ● **type - must be wateruse** ● date - optional ● date_gmt - optional ● author - optional ● password - optional ● post_parent - optional ● post_format - optional ● menu_order - optional ● comment_status - optional ● ping_status - optional ● sticky optional ● post_meta - optional	On a successful creation, a 201 Created status is given, indicating that the post has been created. The post is available canonically from the URL specified in the Location header. The new Post entity is also returned in the body for convienience. If the client is not authenticated, a 403 Forbidden response is given.

Table 8 WUV API to create a water use post

To the effects of the SMP, lines 55 to 72 show that the JSON form allows the flexibility to describe and determine various types of posts, text based, images, or even the points that can be gathered through the gamification layer that is being proposed as part of the deliverables of the SMP.

Example: wateruse type in JSON form

```
1.  {"userid":"1",
2.   "time":"\\/Date(1431558000000)\\/",
3.   "activity":[{"purpose":5,"duration":1}]}
```

Table 9 Water use post type in JSON form

Example: Water use type "purpose " parameter enum definition

```
1.  public enum purpose
2.  {
3.      Shower = 1,
4.      bathing,
5.      toiletflushing,
6.      dishwashing,
7.      handwashing,
8.      teethbrushing,
9.      shaving,
10.     carwashing,
11.     laundry,
12.     housecleaning,
13.     cooking,
14.     petwashing,
15.     gardening
16.  }
```

Table 10 water use purpose definition in enum form

Example: wateruse post type

```
1.  [
2.  {
3.  "ID": 372,
4.  "title": "another points",
5.  "status": "publish",
6.  "type": "wateruse",
7.  "excerpt":"{\"userid\":\"1\",\"time\":\"\\/Date(1431558000000)\\/\",\"activity\":[{\"purpose\":5,\"duration\":1}]}"
8.  "author": {
9.  "ID": 1,
10. "username": "admin",
11. "name": "admin",
12. "first_name": "admin",
13. "last_name": "",
```

14. "nickname": "admin",
15. "slug": "admin",
16. "URL": "",
17. "avatar":
    "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-content\/uploads\/avatars\/1\/d92bdc
    b385f749d7bf9843bf16657975-bpfull2.jpg",
18. "description": "",
19. "registered": "2014-09-30T15:47:33+01:00",
20. "meta": {
21. "links": {
22. "self": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/users\/1",
23. "archives": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/users\/1\/posts"
24. }
25. }
26. },
27. "content": "",
28. "parent": null,
29. "link": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wateruse\/another-points\/",
30. "date": "2015-05-13T18:49:02",
31. "modified": "2015-05-13T18:49:02",
32. "format": "standard",
33. "slug": "another-points",
34. "guid":
    "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/?post_type=wateruse&p=372",
35. "excerpt": null,
36. "menu_order": 0,
37. "comment_status": "closed",
38. "ping_status": "closed",
39. "sticky": false,
40. "date_tz": "Europe\/London",
41. "date_gmt": "2015-05-13T17:49:02",
42. "modified_tz": "Europe\/London",
43. "modified_gmt": "2015-05-13T17:49:02",
44. "password": "",
45. "meta": {
46. "links": {
47. "self": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/posts\/372",
48. "author": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/users\/1",
49. "collection": "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/posts",
50. "replies":
    "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/posts\/372\/comments",
51. "version-history":
    "http:\/\/w7-csstzzw2.ikb.brunel.ac.uk\/SMP\/wp-json\/posts\/372\/revisions"
52. }
53. },
54. "featured_image": null,

```
55. "terms": [ ]
56. }
57. ]
```

Table 11 water use post type in JSON form

7.3. RS API

Create a reward

Similar to the water use input, the gamification interaction will also use the *post* method to transmit a game specific post type to the platform to update the rewards for a user. The important data to be tailored for such a service is highlighted in the following table in the **input JSON body** column. The *excerpt_raw* must be "gameplaytype" json and the type must be "gameplay" type. Note that "gamelay" can be specifically defined in accordance to the use requirements and must be registered in the platform.

URL	Method	Description	Input JSON body	Output
/wp-json/posts	POST	Create a rewards	{"title":"Hello World!","content_raw":"Content","excerpt_raw":"**Gameplaytype**"} The data parameter should be an object containing the following key value pairs: ● ID - required ● title - required ● content_raw - required ● excerpt_raw - optional ● name - optional ● status - optional ● **type - "gameplay"** ● date - optional ● date_gmt - optional ● author - optional ● password - optional ● post_parent - optional ● post_format - optional ● menu_order - optional ● comment_status - optional	On a successful creation, a 201 Created status is given, indicating that the post has been created. The post is available canonically from the URL specified in the Location header. The new Post entity is also returned in the body for convienience. If the client is not authenticated, a 403 Forbidden response is given.

| | | | ● ping_status   -
optional
● sticky optional
● post_meta   -
optional | |

Table 12 RS API to create a reward

Get rewards

URL	Method	Description	Input JSON body	Output
/wp-json/posts ?type[]=gamepl ay	GET	Retrieve rewards	N/A	The response is a Post Collection document containing the requested Posts if available.

Table 13 RS API to get a reward

7.4.   ES API

Create evaluation data

The important data to be tailored for such service is highlighted in the following table, in the input JSON body column. The **excerpt_raw** must be "estype" json and the **type** must be "evaluationtype" type. Note that various types of "evluationtype" can be defined, in accordance to the use requirements.

URL	Method	Description	Input JSON body	Output
/wp-json/posts	POST	Create a post	{"title":"Hello World!","content_raw":"Content","excerpt_raw":"**estype**"} The data parameter should be an object containing the following key value pairs: ● ID - required ● title - required ● content_raw - required ● excerpt_raw - optional ● name - optional ● status - optional ● **type - "evaluationtype"** ● date - optional ● date_gmt - optional	On a successful creation, a 201 Created status is given, indicating that the post has been created. The post is available canonically from the URL specified in the Location header. The new Post entity is also returned in the body for convienience. If the client is not authenticated, a 403 Forbidden response is given.

			- author - optional - password - optional - post_parent - optional - post_format - optional - menu_order - optional - comment_status - optional - ping_status - optional - sticky optional - post_meta - optional	

Table 14 ES API to create an evaluation post

Get evaluation data

URL	Method	Description	Input JSON body	Output
/wp-json/posts ?type[]=evaluat iontype	GET	Retrieve evaluation data	N/A	The response is a Post Collection document containing the requested Posts if available.

Table 15 ES API to get an evaluation post