

Team 5

NGRY HUB virtual testbed

November, 2019.

1. Project description

Our client is Future Energy Center, MDH. The European Regional Development Fund project, NRGY HUB, aims at creating a HUB for innovative energy solutions, and one important part of the project is a virtual testbed that will digitally describe a city with open data on its various flows with regards to energy, water, traffic, and waste.

1.1. Problem formulation

The objective of this project is to build an interactive webpage that will display different information stored in a database. The database will include information about energy consumption and district heating of several buildings in the city of Västerås (Sweden), the information will be provided by a local energetic company by the name of Mälarenergi and will be stored on a local database. The data will be fetched by the webpage that will use the information to create a small area on the map, creating a cluster of buildings. This area will show the information of energy consumption and district heating of at least five buildings that are close to each other to be in line with GDPR regulation.

2. Team Work

The group involves eight people with different backgrounds in computer science. The members of the group are:

- Donatello Piancazzo - Project manager
- Nejra Bahtić - Power point manager / Documentation manager
- Andrés Ramos Segui - Power point manager

- Juan Eduardo Soberanis Gómez Farías - Documentation manager
- Clara Wiman - Meeting secretary
- Isabelle Agirman - Team member
- Oskar Berglund - Team member
- Muhammad Tariq - Team member

All the members have taken some responsibility in the group and will be involved in the development part as well.

The team will weekly discuss and plan different meetings, where to work together on the multiple deadlines for the project. This will be achieved by booking rooms at Mälardalens University.

During the meetings the team will evaluate the work done in the period before the meeting and divide the upcoming tasks. The work to be done in the period between the meetings will be decided by the team and picked from the product backlog.

The work flow and meetings will be discussed by the members of the team on Whatsapp(an instant messaging application). To check the different deadlines and to check which element to work on, the team will set up different activities on a managing platform called Trello. The material for the project will be uploaded to a shared folder uploaded on Google Drive, meanwhile the software parts, as well as documentation will be uploaded to Github.

To check the amount of hours that each member of the team has spent on the project, each member will be responsible to update an excel form present in the team's drive.

In order to develop a high quality product, the team will make sure to keep the client informed on the upcoming changes to the software. This will be achieved with weekly meetings to ensure that the work done matches the client's expectations.

To make sure that both documentations and presentations maintain a high quality we will ensure that each member of the team evaluates the material before it will be handed in. The team will achieve this by moving the completed tasks in the "validate" section on Trello where all

the members will check the work and check the box next to their name. After the completion of the previous part, the project manager will move the task to the “Done” flow.

3. Deadlines

The team has set up different deadlines for this first part of the project and divided them in three major sections.

3.1. Documentation

Task	Due date
Project plan	21 November
Detailed design	5 December
Product documentation	5 December
Project report	16 January

3.2. Presentation

Task	Due date
Project plan	27 November
Preliminary design presentation	11 December
Final presentation	15 January

3.3. Project planning in weeks

Task	Amount of weeks
Requirements	1
System architecture	<1

Layout	1
Database	1
Webpage	2
Integration	1,5
Deployment	1,5

4. Technologies

Technologies are a very important part of our implementation. We decided to choose specific technologies for front-end, back-end and database and to have the ability to integrate them and deploy to AWS easy.

4.1. Front-End

Front-End technologies we are planning to use are HTML, CSS and JavaScript. We are going to use them integrated in ReactJS. ReactJS is javascript library for building user interfaces. We will use ReactJS with all its benefits for building our web page. We are going to use OpenStreetMap as well for presenting our data and information.

4.2. Back-End

Because of our will to deploy everything on AWS if we manage, we are planning to use Java for Back-End and writing services. Java is class-oriented and object-oriented programming language that is really popular nowadays. Using Java with Spring boot is really beneficial because it is supported from different types of frameworks and databases. It is compatible with AWS as well.

4.3. Database

Since we have different type of data to store, we agreed upon two databases, one for user information and the other for data. Databases are not linked between so we are going to use Non-Relational Databases and we want the data to be stored as JSON object. Because of that our choice is MongoDB. Also MongoDB is supported by AWS, which is also important to us.

5. Functionalities and requirements of the system

We believe that this solution aims to collect and gather information in one place. It should display collected information about water, electricity and make information easily accessible by different parties.

5.1. Functionalities

We divided functionalities of the system based on priority in two categories, basic functionalities and expand functionalities.

Basic functionalities are short term and we want to implement them in the following 8 weeks. They are:

- Registration and login
- Work with local copy of OpenStreetMap (OSM), and investigate similarities with for example AWS Maps
- Showing clusters on the map
- Displaying electricity and district heating information
- Creating databases and import of data from provided excel documents

Expand functionalities are long term and we will implement them if we manage in the end. They are:

- Deploying everything on AWS
- Admin panel with roles and permissions

In the beginning of the implementation, the system is going to interact with OpenStreetMap (OSM). In addition, we will have to make it to interact with the excel document that will provide the information that we are going to display on the map. The information of this excel document, should be stored in database. This database has information about the location of the meters and other things that excel document provided to us. We can only access data from companies that agreed to share their data based on GDPR. Companies that are sharing their data will be provided through another excel document. Therefore we can say that GDPR presents one of the constraints for our work. *(These data will be provided to us through excel*

document from our client. We will have to extract data from excel document and insert data to our databases.)

Excel document consist of the following columns with data:

- Field/Area - where the meter is located in the city
- ID - ID of the meter to have difference between them
- Connection - The ID of the meter where the distribution starts from
- Delivery point - The ID of the meter where the distribution arrives for different places on the same ID
- Type - The type of use the customers does. 0 for consumption and 1 for production
- Connection date - The date they connected to the network
- Number of the counter - The number of the counter
- EAN - Barcode for the counter
- Network type - Type of network, will display 1 for electricity and 2 for district heating
- Fare - The fare that the user has to pay to the company depending on usage
- Yearly spent energy - Average amount of energy used within one year
- Effect energy - The effect of used energy explained in kW/h

We are going to use the mentioned columns to create our database with data extracted from that excel document and after for displaying information on our map.

When the user clicks on a building that is private, the data cannot be shared. The proposal is to display clustered information, meaning that we should present average measurements on the closest buildings that have shared data.

We need to display meters on the map, based on their functionality. For example, if we display electricity then we are going to use blue dots meanwhile when displaying water we are going to use red dots. All dots should be related to the near buildings, but presented on map based on their coordinates. The information that is going to be shown will represent the usage related to a cluster of at least 5 buildings.

For now, we do not have any roles in the system. System should provide information about water and electricity in the specific area to all its users. The proposal from our client is that at the end, if we have enough time, we should make admin panel with roles and permissions.

Therefore, the roles that this system should have are admin and users with different permission to see specific data, but for now system has regular users only.

5.2. Requirements

Identity	Priority	Description
1	High	<u>Registration page</u> Definition: The user must be able to register to be able to login. Motivation: To give the users access to the system.
2	High	<u>Login page</u> Definition: The user must be able to login with their account to access the main functionalities that the system provides. Motivation: So the user can see anything related to the system.
3	High	<u>Visible map</u> Description: The user should have the possibility to see a map of the city with all the locations where information is gathered. Motivation: To have a visuall and clear picture of the city with the buildings.
4	High	<u>Cluster information of area</u> Description: The user should see clustered information (water and electricity) about minimum 5 buildings when clicking on the area. Motivation: To see the clustered data related to that specific area.
5	High	<u>Display meters</u> Description: The meters on the map should be displayed with different colors depending on the type of meter. Motivation: To clearly see what type of meter it is.
6	Low	<u>Amazon Web Services</u> Description: The system should be in AWS (Amazon Web Services). Motivation: Easier accessibility to amazon services, databases, easier deployment and change management.
7	Low	<u>Admin panel</u> Description: The system should have an admin panel, where an admin can login and have permission to everything. Motivation: So an administrator with highest permission can have full control and change things.
8	Low	<u>Different roles for users</u>

		<p>Description: The system should have different roles with different permissions for each group of users.</p> <p>Motivation: So different users can have access to different things, one company can only see it self's data.</p>
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6. Login

As the requirements specify, the login form is going to give access to the functionalities that the system provide for our users. For now, the idea is to have universal user, so login in means we give access to our system to users. But later on, our plan is to have roles and permissions, so then based on the credentials (client or admin), users will be rerouted to their respective landing page (admin or client main view).

7. Product Backlog

In the following scheme it's possible to check the detailed structure of the product backlog that is set up in the phases on how the project will be done.

Requirements	Documentation	Project description and specifications of our system
	Presentation	Slides that we have to prepare for every meeting and class presentations
System Architecture	System design	Definition of user interfaces, architecture, modules that we are planning to use in order to make our system functional and better
	Technology	Definition and specification of technologies (Front-End, Back-End and Database) that we are going to use to implement our system
	Open Street Map	Main technology that we are going to use to display map

		of the city or selected area with pins and information
Layout	Mock-ups	Design of our web page, what should be added to UI and how to place what we should present on that page
	Color palette	Colors to match the design of the page
	Fields to display	Input fields we need on page as well as buttons
Database	Database requirements	Definition of databases and why we need them
	Implementation/Testing	Implementation of database in the context of writing services and making it possible to save things to database. Testing while doing that
	Structure	Choosing should it be relational or non-relational based on requirements
Webpage	Login/Registration	Form for the users to enter their credentials in order to have access to the system
	Implementation/Testing	Development of UI, implementation of designed forms and testing while doing that
Integration	Integrate	Putting everything together and integrating in one final system
Deployment	AWS	Deployment of web services, databases and everything that should be deployed on AWS

8. Gantt Chart

In the next chart (**Gantt chart**) is possible to check the time scheduled for each activity in the product backlog.

