

Smart City - a Quest for Innovation within the EPS Framework

dr inż. arch. Małgorzata Hanzl

Institute of Architecture and Town Planning
Lodz University of Technology, Poland

Students:

Antonina Młynarczyk
International Faculty of Engineering, TUL, Poland

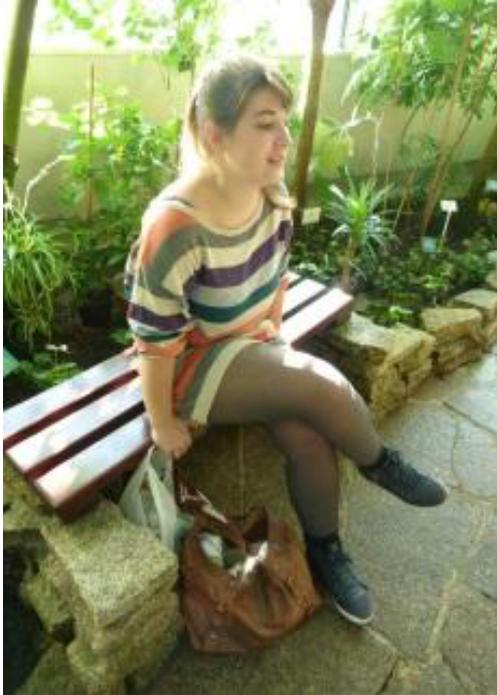
Alizee Tessier
Faculty of Industrial Engineering, École Nationale d'Ingénieurs de Tarbes ENIT, France

Marcos Meiriño Munoz
Faculty of Computer Science, University Complutense de Madrid, Spain

Iban Micieces
Faculty of Industrial Engineering, University of Basque Country, Spain

Fanny Noirot
Université d'Orleans, Eco Technologies Engineering, France





Fanny Noirot
Eco Technologies Engineering
Université d'Orleans, France



Alizee Tessier
Faculty of Industrial Engineering
ENIT, France



Iban Micieces
Faculty of Industrial Engineering
University of Basque Country, Spain



Tutor: **dr Małgorzata Hanzl**
Institute of Architecture and Town Planning
Lodz University of Technology, Poland



Antonina Młynarczyk
International Faculty of Engineering,
Lodz University of Technology, Poland



Marcos Meiriño Munoz
Faculty of Computer Science
University Complutense de Madrid, Spain

“The name SmarTeam was chosen by team members as a symbol of connectivity. It is combination of two words, SMART from the Smart City project name, and (...) TEAM. The name is written only with one T to underline how important relations are for SmarTeam members. “

EPS Report: Smart City project 2013/2014, International Faculty of Engineering, TUL

Slogan: **The best way to connect the city**



SmarTeam logo – design: Joanna Młynarczyk



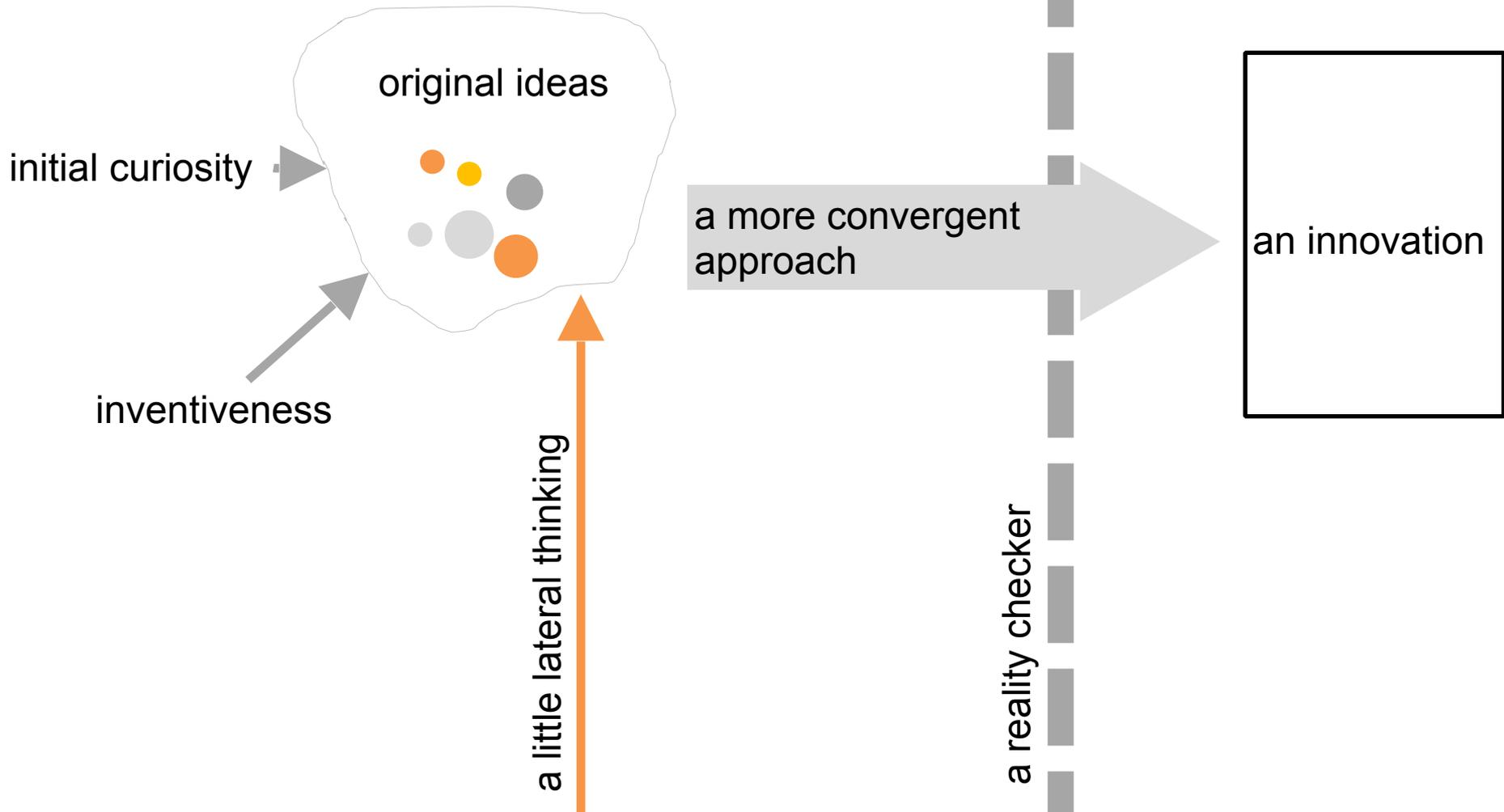
REAL CORP 2014

PLAN IT SMART__CLEVER SOLUTIONS FOR SMART CITIES 21-23 May 2014
VIENNA

Creativity - an applied imagination using qualities such as **intelligence, inventiveness, and learning** along the way.

LANDRY, Charles: The Creative City. A Toolkit for Urban Innovators, Earthscan, London 2009

Original ideas result from initial curiosity and innovation and after a little lateral thinking they require a more convergent approach that takes them through a reality checker from which an innovation might emerge.



Project Based Learning methodology:

- allows a more efficient and useful learning process
- provides a framework for shaping innovative ideas

European Project Semester (EPS) at Lodz University of Technology, International Faculty of Engineering. Program addressed to bachelor level students in the 3rd year of their studies as maximum. EPS is offered by 13 universities in 11 EU countries.

The team of 5 students (aged 20 to 22), from various European countries:

- Spain
- France
- Poland

a wide range of fields of engineering:

- computer science
- biomedical engineering
- management



REAL CORP 2014

PLAN IT SMART__CLEVER SOLUTIONS FOR SMART CITIES 21-23 May 2014
VIENNA

Project Based Learning methodology:

- the emphasis on team work
- entrepreneurial skills
- collaborative problem solving.

4 main stages of the project:

- **forming** – getting to know each other
- **storming** - developing of shared understanding of the defined problem, adjustment and adaptation to the group environment
- **norming** - deeper involvement of participants in the project
- **performing** - implementation, the stage of productive work
- (Andersen, 2009).

The project is accompanied by Team Building and Project Management courses, giving students the opportunity to learn some presentation and communication skills.



REAL CORP 2014

PLAN IT SMART__CLEVER SOLUTIONS FOR SMART CITIES 21-23 May 2014
VIENNA



a strongly collaborative environment, the team spirit, esprit, team morale, common bond, cooperation...



the team spirit, esprit, team morale, common bond, cooperation...

Rules for the group work

- In case of a disagreement in the team: "Keep calm, make yourself a cup of tea or coffee, and find solutions."
- Everybody has the opportunity to speak and express until he/she feels that the team understands. Too long comments will be stopped.
- It is important to discuss feelings but more important to discuss concrete knowledge
- The best way to learn how to function in a team it is to listen to each other and work together



REAL CORP 2014

PLAN IT SMART__CLEVER SOLUTIONS FOR SMART CITIES 21-23 May 2014
VIENNA

Team building

Definition of smart city

State of art

Diagnosis: good/bad points, chances, obligations

Proposals/ Ideas/ Solutions

Selection of ideas

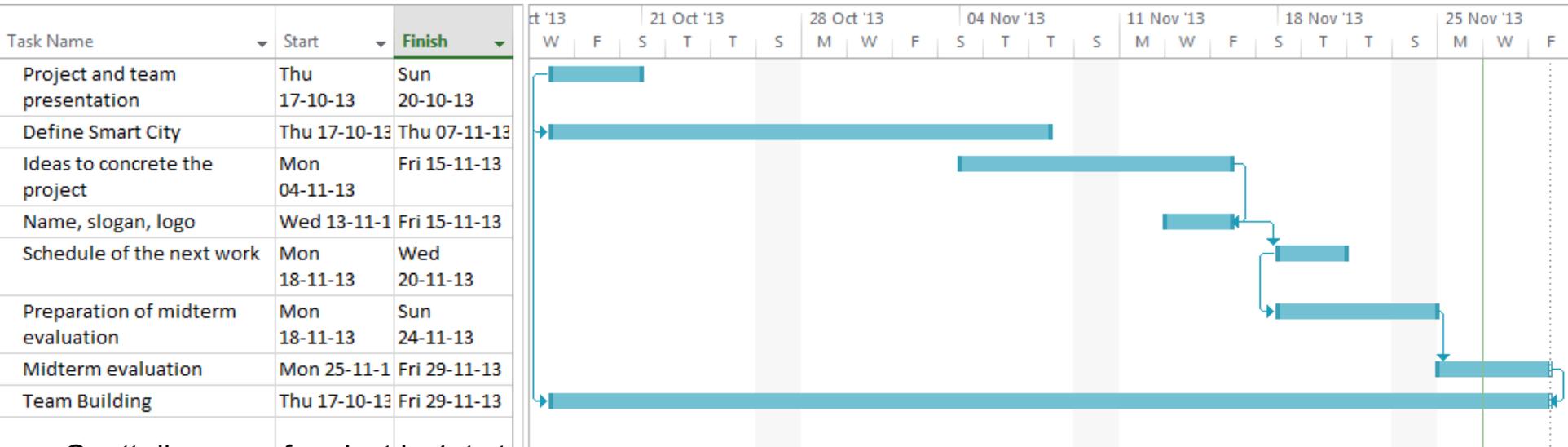
Development of ideas

Realisation

Report and final presentation

start

end

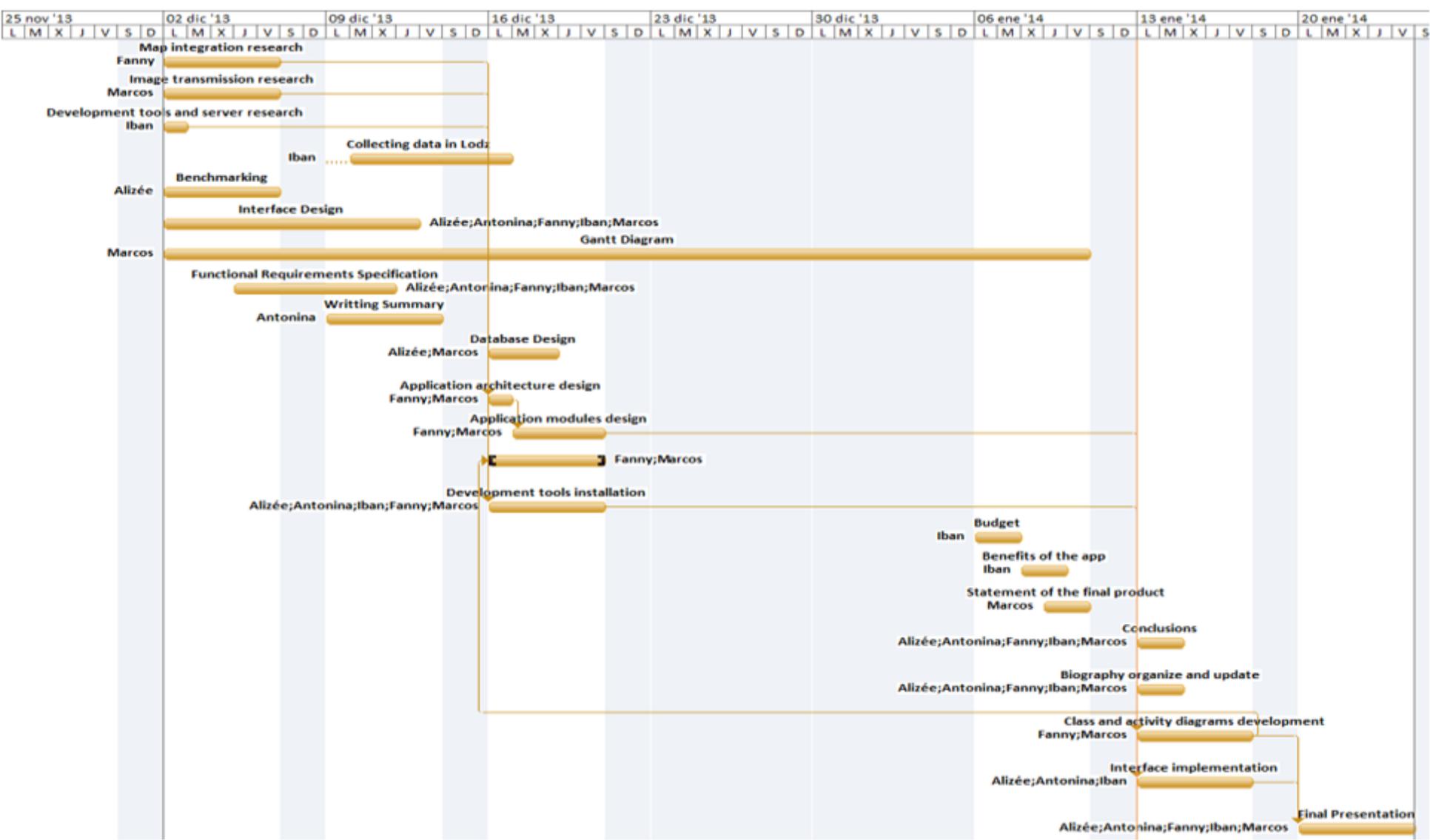


Gantt diagram of project in 1st stage



REAL CORP 2014

PLAN IT SMART__CLEVER SOLUTIONS FOR SMART CITIES 21-23 May 2014 VIENNA



Gantt diagram of the project in 2nd stage



Smart city - *“a developed urban area that creates **sustainable economic development** and **high quality of life** by excelling in multiple key areas; economy, mobility, environment, people, living, and government. Excelling in these key areas can be done so through **strong human capital, social capital, and/or ICT infrastructure**“*

Business dictionary, source: <http://www.businessdictionary.com/>, accessed: 21.12.2013

*“Smart Cities have been characterized and defined by a number of factors including **sustainability, economic development and a high quality of life**. Enhancing these factors can be achieved through infrastructure (physical capital), human capital, social capital and/or ICT infrastructure.”*

Source: <http://ec.europa.eu/digital-agenda/en/content/defining-smart-cities>, accessed: 21.02.2014

The emphasis on the **issues of governance and planning and the social participation and collaboration** in defining the goals for future.

Batty, Michael: The New Science of Cities. MIT Press, Boston 2013

The impact of smart cities' phenomena on science, technology and competitiveness and on society itself.

Batty, M. et al: Smart cities of the future. The European Physical Journal Special Topics Volume 214 (1) 2012, pp 481-518



PLAN IT SMART__CLEVER SOLUTIONS FOR SMART CITIES 21-23 May 2014
VIENNA

Smart city - *"revolution intervening in terms of a new infrastructure and platform, made of both virtual and physical elements, enabling citizens, users and all different urban players to carry on activities and realize applications thanks to the opportunity allowed by improvements in technology and its widespread presence"*

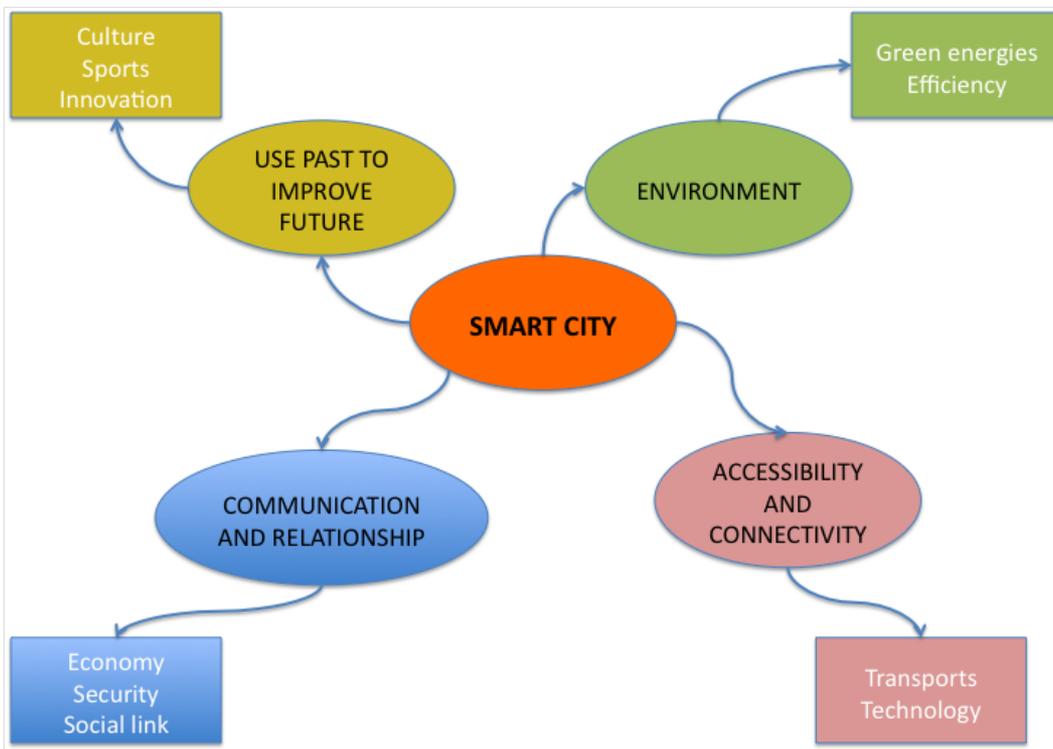
Murgante, B., Borruso, G.: Cities and Smartness: A Critical Analysis of Opportunities and Risks. *Lecture Notes in Computer Science* 7973, 2013, pp. 630–642

"A Smart City is a place where citizens interact with the city in order to satisfy their necessities (relationship, communication, green energy, economy, connectivity, accessibility, culture) and improve their quality of life using new technologies." (EPS Report, 2014).

The emphasis on social and cultural aspects of urban development is also expressed e.g. by Carlo Ratti in his talk 'Decalogue for a "SENSEable" City' (2013), where he talked *"not about technology, but about us"*.

As William H. Whyte (2009) discerns *"what attracts people are first of all other people"*.





Graphical representation of Smart City and its aspects.
Source EPS Report 2014.

Key fields of urban and technology development and 4 potential areas of the project:

- (1) accessibility, with an emphasis on public transportation,
- (2) connectivity, including also the broader theme of improving the quality of interpersonal relations and building social capital,
- (3) green energy and environmental protection
- (4) "culture and innovation"



4 aspects of Smart City

City environment

- Cities as inherent parts of the environment.
- Bringing “nature” into the city.
- Lack of proper care for the environment in the past.
- The simplification of urban landscape generates a loss of biodiversity.
- Trials to respect and protect the environment inside the city, creating green areas, parks and using green energy in order to reduce the pollution of the atmosphere and prevent climate changes.

Communication and relationship

- Communication - *“the process by which information is passed between individuals and/or organizations by means of previously agreed symbols”* (P. Little 2012).
- Technology enables effective communication but its speed may constrain the ability to build meaningful relationships.
- Effective communication anticipates citizen’s requirements. It uses codes: colours, light, sounds, signs, it enhances mass collecting of information, i.e., crowd-sourcing, it assists process organisation or just provides a communication platform (Hanzl, 2007).

Culture and innovation

- Cities compete to provide comfort, which requires satisfaction of human needs: security and safety, education, etc.
- The recognition of the city’s own culture and history is key for knowledgeable and respectful development.
- Every area of human activity may be enhanced with the use of technology: education, sports or musical and theatre spectacles.
- The constraints are creativity and organisation, the background is the adjustment to local culture.

Connectivity and accessibility

- The transportation system: accessibility of goods and citizens' mobility – effective management.
- Availability of interactive information increases the comfort of commuters, thus significantly improving travel conditions.
- The role of pedestrian movement as a form of transportation.
- *“ (...) smart-smart urbanism should follow specific planning principles, privileging the complexity of ground-plane design, recognising the cognitive value of pedestrian experience.”* (Senett, 2012)



There is the need to understand *"the implications of how the city is being wired, how it is generating new data, how this data might force **new theories and models** relevant to our understanding, how we might use our **strategic models and intelligence** to plan the city"*

Batty, M.: Smart Cities, Big Data, Editorial. In: Environment and Planning B: Planning and Design 2012, Vol. 39, pp. 191-193

Severe critics of an approach favouring concentration on technology and infrastructure and **overlooking the intelligence of citizens and human capacities**, as leading to amounts of useless technological innovations.

Boni, M.: Czeka nas redefinicja roli miasta. In: THINKTANK: Raport Przyszłość miast, Miasta przyszłości, Strategie i wyzwania innowacje społeczne i technologiczne, Warsaw 2013, pp.36-37

Cities tend to urbanise technologies. How to implement intelligent systems enhancing urbanisation rather than deurbanising cities. How to put the technology *"at the service of inhabitants, not the other way around: the inhabitants as incidental users."*

Sassen, S.: Urbanising Technology, Urban Age Electric City Conference. In: LSE Cities, London School of Economics, Eds.: Burdett Ricky, Rode Philipp. London 2012, pp.12-14



Miasta
dla ludzi
Jan Gehl



Premiera polskiego
wydania książki
„Cities for people”

Instytut Gospodarki Przestrzennej Uniwersytetu Łódzkiego
Fundacja Ulicy Piotrkowskiej
zapraszają

Wizyta
prof. Jana Gehla w Łodzi
4-6 listopada 2013 r.

prof. Jan Gehl
Katedra Architektury i Urbanistyki

Miasta dla ludzi

więcej informacji pod adresem www.piotrkowska.pl

organizatorzy:



partnerzy:



patronat honorowy:



A visit of prof. Jan Gehl to Lodz,
the event's poster

Source: <http://piotrkowska.pl>

the **determinative**

use of technology

closed systems

fixed and thus oppressive

versus

the **coordinative**

use of technology

open systems

may be further developed

allow flexibility

take into account citizens' needs

Sassen, S.: Urbanising Technology, ibid

The use of remote media hasn't removed the need for direct social interaction. As *"the constraints of geography are lifted, people, businesses and ultimately cities aggregate even more"*

Offenhuber, D., Ratti, C.: Mapping the Future, Connecting Minds, Creating the Future, Book of Essays, EXPO 2020 Dubai, UAE, source: <http://expo2020dubai.ae/en/theme/essays>, accessed 20.02.2014

The Smart City concept at the local level:

1. to invent new means for consultation and conception of the city
2. to enhance local resources and identities of a territory
3. to experiment with new products and services on a digital city
4. to study new urban uses
5. to mobilize users, local stakeholders around the territorial project



PLAN IT SMART__CLEVER SOLUTIONS FOR SMART CITIES 21-23 May 2014
VIENNA

“So what is a Smart City? And how can we define it? As you can see in the previous parts, we tried to understand the main ideas and aspects of Smart Cities. How they should be. How people should feel in such cities. And we figured it out, that the really important thing is just to think smart! Think smart about how you can use new technologies and apply them in the city. How, in a smart way, you can make transportation in the city, easy, fast and comfortable. How not to waste energy but use it? How to make people feel safe and happy in their daily life. How to make them ACT smart.”

EPS Report 2014

Methods: lectures, internet and library queries, own observation based on individual experiences of cities which participants come from or are familiar with: Lyon, Paris, Madrid and Bilbao. These insights were contrasted with the reality of the former 19th century textile industry centre and post-socialist city - Lodz.

The project was focused on **smart solutions required to improve human life in urban areas**.

The **smartphone application** has been developed as a tangible result, as part of a general trend of development of easy and available tools facilitating everyday citizens' life (Townsend, 2013, pp.200-203).

An application enhancing citizens social needs of direct presence and acquiring knowledge about the city. The implementation phase: a reality check in the urban environment of Lodz city centre.



Name	Short description	Platform	Food	Bar	Culture	Profile	Hotel	Comment	Transport	Vote	Handicap
 Tripadvisor	An application used all over the world to organise trips: visits, pubs, hotels, restaurants	Android, Apple	✓	✓	✓	✓	✓	✓	✗	✓	✗
 Avabar	Social application used to meet people and join friends in bars and clubs all over the world	Android, Apple	✗	✓	✗	✓	✗	✓	✗	✗	✗
 Foursquare	An application to find out what there is to do / going out	Android, Apple	✓	✓	✓	✓	✓	✓	✗	✓	✗
 Ville de Lyon	An application used to go out (culture and gastronomy) find out everything that is taking place in this city.	Android, Apple	✓	✓	✓	✓	✓	✓	✓	✓	✗
 ParisApps	A set of applications enabling visitors to go out, visit, use transport. Just one function performed by one application.	Android, Apple, Blackberry, Windows	✓	✓	✓	✓	✓	✓	✓	✓	✗
Insiders' Amsterdam	An application for visiting and finding out what is happening in Amsterdam. Dedicated to tourists.	Android, Apple	✓	✓	✓	✗	✓	✓	✓	✗	✗

Benchmarking. The key features of similar applications. Source EPS Report 2014.



U-place - a Smartphone, map based application

- a **social platform** allowing citizens to express their opinion on various spots in the city
- crowd-sourcing methodology to gather data on urban places - both commercial and public locations: cafes and restaurants, squares and parks
- **comments** on historical and natural heritage sites, evaluation of the experience
- **sharing** favourite places
- a way to communicate, sharing opinion about places in the city
- promote direct meetings

Users add places along with:

- geographical coordinates,
- type,
- photograph
- optionally, a description

Assessment on:

- quality
- price range
- system of comments

Search for location based on such criteria as: name, description, proximity, type, price range

Functional Requirements Specification

The application structure:

- **a server-side app** - stores data and performs the most important processing tasks, including receiving client requests and sending it appropriate responses
- **a client-side app** - on mobile phones, contains an interface to interact with the user and ask the server for the information the user requires.

The functional requirements:

- Adding Information
- Add a new user
- Add a new place
- Add comments on one place
- Modify place information
- Searching places
- Location Search
- User text input search
- Limited search
- Mixed search
- Voting for a place
- Displaying information on a place

A detailed description of the application is covered in the specification included in the EPS Report 2014

Function	Add new user
Priority	High
Stability	High
Description	Adds a new user to our system
Input	Nick Avatar
Output	Confirmation or error message
Source	User
Target	System
Needs	Database Picture storage and transmission
Action	Adds a new user to our system Avatar picture is sent from the client to our server and then stored in the server
Precondition	User must be using our client app
Postcondition	Database and Picture storage updated with the new data
Side effects	None

Function	Add new place
Priority	High
Stability	High
Description	Adds a new place to our system
Input	Name Type Location Picture Description, address, phone and/or e-mail
Output	Confirmation or error message
Source	User
Target	System
Needs	Database Picture storage and transmission
Action	Adds a new place to our system Makes a transmission of the picture from the client to the server
Precondition	User must have an account in our system
Postcondition	Database and Picture storage updated with the new data
Side effects	If another place already existing in our system has the same type, location and a similar name, an information message will be send to the user, who will have to confirm his decision

Function	Add comment to one place
Priority	Average
Stability	Average
Description	Adds a new comment to a place in our system
Input	Comment Place
Output	Confirmation or error message
Source	User
Target	System
Needs	Database
Action	Adds a new comment to a place in our system
Precondition	User must have an account in our system Place must already exist
Postcondition	Database updated with the new data
Side effects	none

Adding information: 1. adding new user, 2. adding new place, 3. adding comment to a place



Function	Location search
Priority	High
Stability	High
Description	Search places in our system near to user's current location
Input	Location
Output	A map with found places
Source	User
Target	System
Needs	Database
Action	Search places in our system near to user's current location
Precondition	User must have GPS location enabled User must be near of any of our places
Postcondition	Places near to user's current location are returned to the client and displayed on the map
Side effects	none

Function	Location search
Priority	High
Stability	High
Description	Search places in our system with information related to user's text input
Input	Text
Output	A map with found places
Source	User
Target	System
Needs	Database
Action	Search places in our system with information on name, description or address related to user's text input
Precondition	Text input is not empty and no constraint is selected
Postcondition	Places containing words in their name, description or address similar to user input are returned to the client and displayed on the map
Side effects	none

Function	Constrained search
Priority	High
Stability	High
Description	Search places in our system with information related to user's selected constraints
Input	Constraint button
Output	A map with found places
Source	User
Target	System
Needs	Database
Action	Search places in our system with information related to user's selected constraints
Precondition	At least one constraint is selected and text field for searching is empty
Postcondition	Places satisfying constraints selected by the user are returned to the client and displayed on the map
Side effects	none

Function	Mixed search
Priority	High
Stability	High
Description	Search places in our system with information related to user's selected constraints and text input
Input	Constraint button and text
Output	A map with found places
Source	User
Target	System
Needs	Database
Action	Search places in our system with information related to user's selected constraints and text input
Precondition	At least one constraint is selected and text field for searching is not empty
Postcondition	Places satisfying constraints selected by the user and containing words in their name, description or address similar to user input are returned to the client and displayed on the map
Side effects	none

2 ways of using U-place: 1. quickly find a good place to go, 2. find the best place for us according to our preferences. Source EPS Report 2014.

Function	Vote a place
Priority	High
Stability	High
Description	Updates place punctuations in our system
Input	Voting buttons selected
Output	Confirmation or error message
Source	User
Target	System
Needs	Database
Action	Updates place punctuations in our system using selected punctuation buttons by the user
Precondition	At least one selected punctuation button is selected by the user The place must already exist User must have an account in our system
Postcondition	Database data about the punctuation of one place is updated with the information provided by the user
Side effects	none

Function	Display place information
Priority	High
Stability	High
Description	Displays information about one place in the client application
Input	Place selected
Output	Error message (Optional)
Source	User
Target	System
Needs	Database Picture storage and transmission
Action	Displays name, picture, type, description, address, phone and/or e-mail and comments about one place in the client application
Precondition	Place is selected The place must already exist User must have an account in our system
Postcondition	Name, picture, type, description, address, phone and/or e-mail and comments about selected place is displayed in the client application
Side effects	none

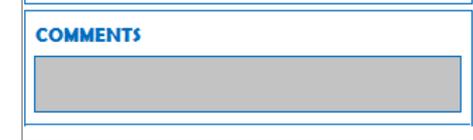
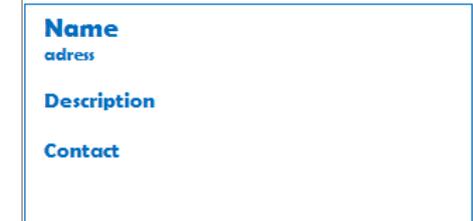
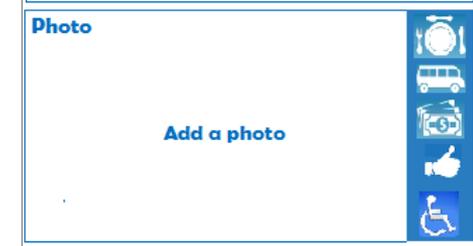
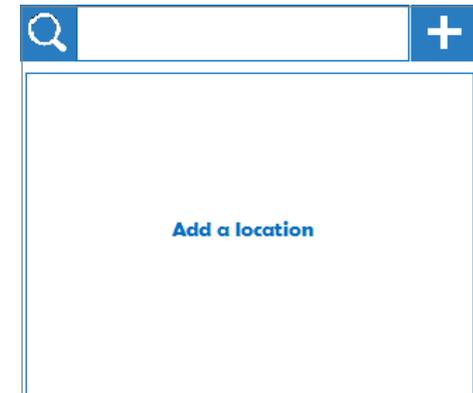
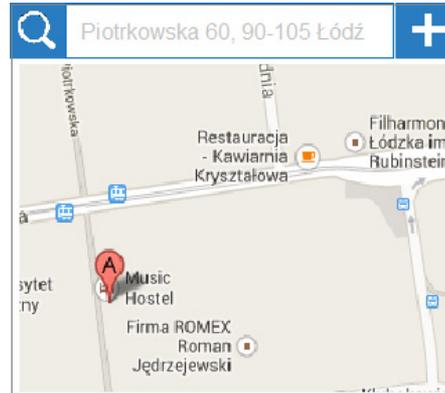
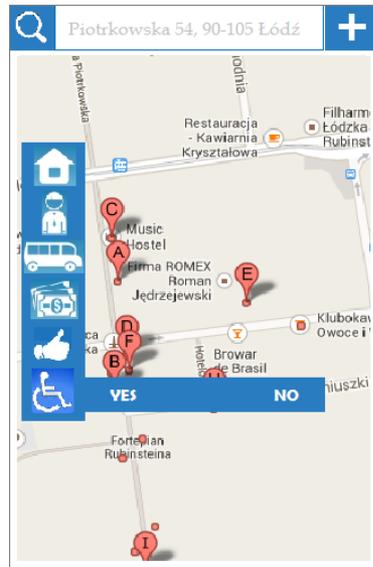
Function	Modifying information on a place
Priority	Average
Stability	Average
Description	Modify information of one place in our system
Input	Name (Optional) Type (Optional) Picture (Optional) Description, address, phone and/or e-mail (Optional)
Output	Confirmation or error message
Source	User
Target	System
Needs	Database Picture storage and transmission
Action	Adds a new comment to a place in our system Makes a transmission of the picture from the client to the server (Optional)
Precondition	User must have an account in our system Place must already exist
Postcondition	Database and Picture storage updated with the new data
Side effects	none

Evaluation, assessment, modifications: 1. voting a place, 2. displaying place info, 3. modifying info on a place

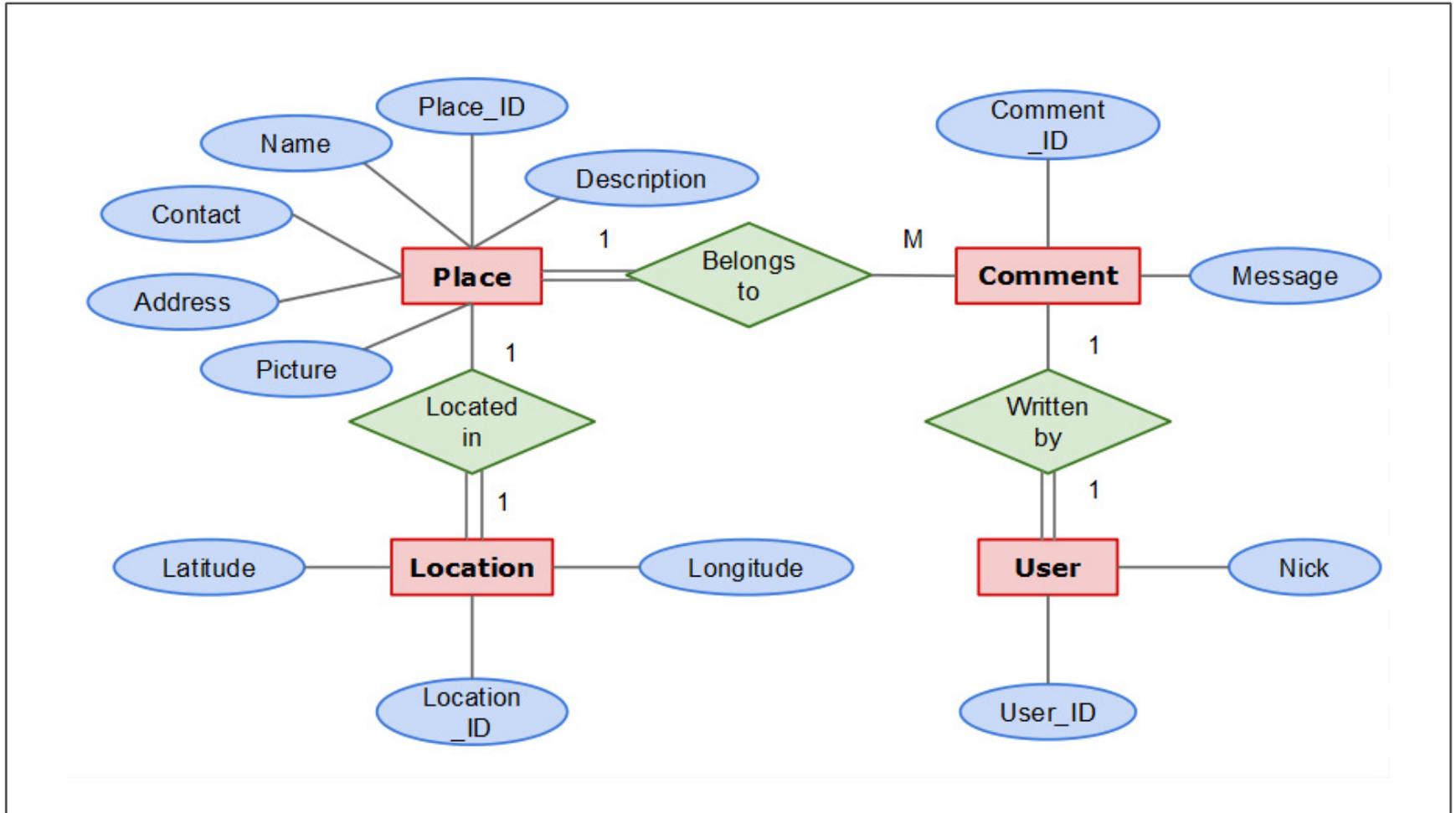
Place	Café Restaurant Hotel Hostel Museum Shop
User	Family Couple Student Elderly people Group
Transport	Parking Bus Tramway Taxi Parking bike
Price	Cheap Normal Expensive
Mark	
Handicap	Yes No

Properties of places



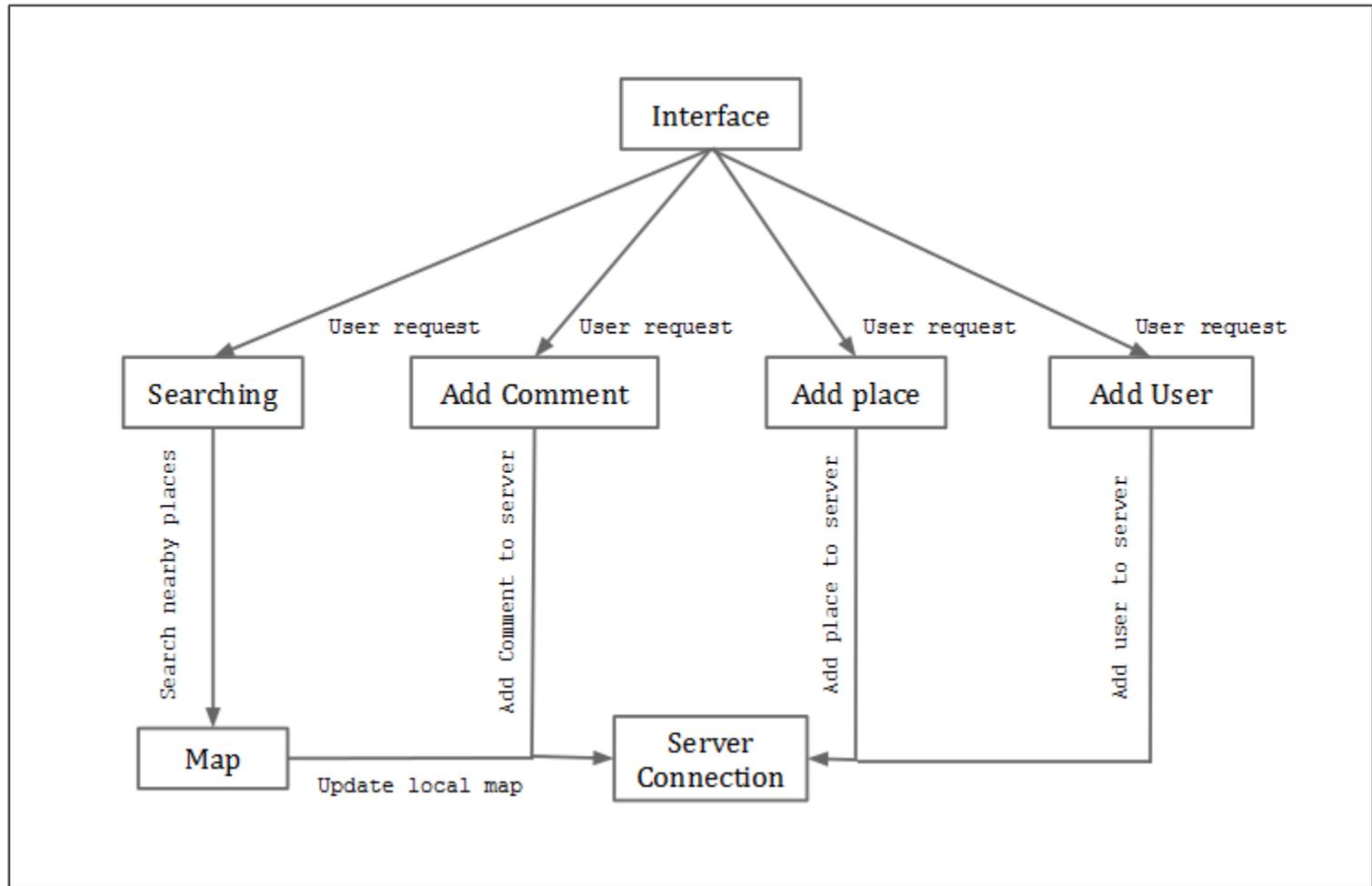


1. The first screen, 2a, b. Itemization (1,2) of the first screen , 3. The exemplary screen of the U-Place application, 4. Add a location . Source EPS Report 2014.



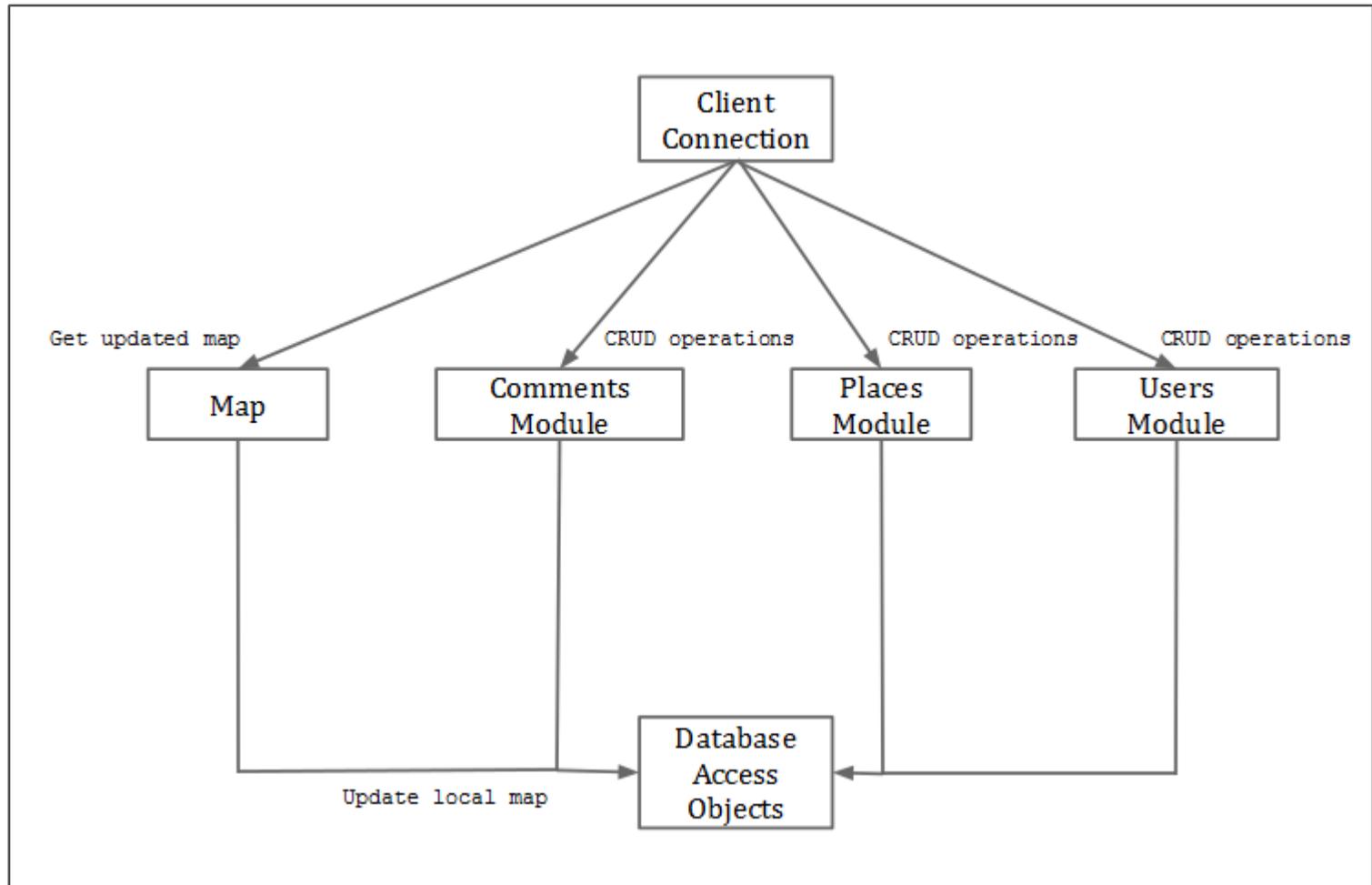
Entity -relationship diagram. EPS Report 2014





Client-side app module diagram. EPS Report 2014

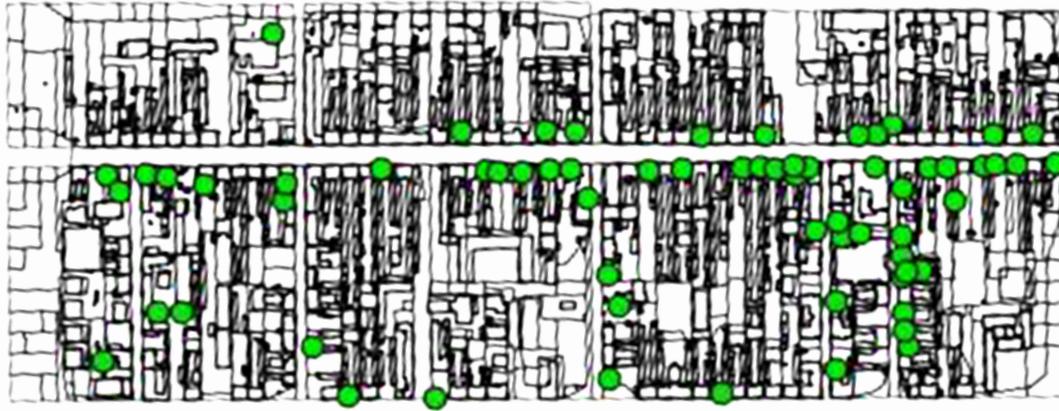




Server-side app module diagram. EPS Report 2014



Work area map and a part of the table representing collected data, Quantum GIS



wkt_geom	id	Type	Adress	Info	Contact
POINT(49619.44958287139888853 50503.7682041430962272)	1	Restaurant	Piotrkowska 56	Every kind of delicious food, from pizza to more elaborate dishes.	Mail: biuro@sfinks.pl Tel: (42) 632 36 82
POINT(49623.08125414423557231 50479.25442305146862054)	2	Hostel	Piotrkowska 60	It is situated in the heart of city in Piotrkowska street which is the cultural and night life centre.	Tel:+48 533 533 263
POINT(49624.89708978065027623 50462.91190232372173341)	3	Restaurant	Piotrkowska 60	Delicious tapas, desserts and wines and of course Polish beer.	Mail:deseo.tapas@gmail.com Tel:42 207 18 56
POINT(49673.01673414569813758 50435.6743677746479493)	4	Company	Piotrkowska 66	Since 1999 this company is dedicated to the coordination and implementation of research projects in fact all types of classes	Tel:604 784 343 Mail:omnibus@e- omnibus.com
POINT(49631.25251450810901588 50419.33184704971790779)	5	Tattoo shop	Piotrkowska 66	Tattoo and piercing shop with the best team of experts.	Mail:info@hardtoforget.pl Tel: 42 662 08 09
POINT(49634.88418578094569966 50397.54181941271235701)	6	Photography shop	Piotrkowska 68	It is a company working in the photographic industry; We have been in Łódź market for over 14 years	Tel: 42 633 28 63 Mail: kontakt@foto54.pl
POINT(49666.66130941823939793 50369.3963670482534252)	7	Restaurant	Romualda Traugutta 2	It is a very popular Polish restaurant franchise serving Polish dishes	Tel: +48 42 632 43 23
POINT(49724.76804978357540676 50375.75179177571408218)	8	Restaurant	Romualda Traugutta 4	You can find here the best Hungarian food in a typical Hungarian restaurant.	Tel. (42) 632 45 46 Mail: varoska@varoska.pl
POINT(49764.71643378474982455 50388.46264123063156148)	9	Restaurant	Romualda Traugutta 6	High polish cuisine	Fax: 42 632 15 42 Tel: 601 97 75 10
POINT(49763.8085159665424726 50403.89724414017109666)	10	Hotel	Romualda Traugutta 6	The hotel offers 123 beds in apartments and rooms for 1, 2 and 3 persons.	Tel:+48.42 632 93 60
POINT(49839.16569487783999648 50393.00223032166832127)	11	Restaurant	Romualda Traugutta 9	This is a fish and Chip shop franchise in Poland.	Tel: +48 662 039 339
POINT(49856.41613342379423557 50401.17349068554904079)	12	Shop	Romualda Traugutta	Urban fashion store. You can find every kind of modern clothes.	Tel: +48 42 634 01 22

Statement of the final product

Finished parts:

- a complete analysis of the application, including:
 - functional requirements,
 - specification
 - interface design
- the most important stages of the design of the app, including:
 - the architecture design
 - database design
 - a complete module design

To be done:

- within the design process:
 - class diagrams for all the server code and most of the client code
- the implementation of the code
- testing and maintenance processes in an incremental process, building a small functional prototype in the first instance and improving it with some iterations, using Scrum methodology



Conclusions and further development

An **innovation** within the process of education in the field of Smart City technology

The initial research on Smart Cities let students define further activities and led them towards more citizen oriented solutions: *"the project was focused on smart solutions required to improve human life in urban areas"* the approach similar to the one of the chief researchers in the field, e.g. Ratti (2013)

The U-place Smartphone application - a social platform allowing citizens to express their opinion on various spots in the city. An objective: *"to help people to be connected with the city and other citizens"*.

The current functionality of the application is simple and easy to manipulate. It allows users to find a desired location, to comment on a place, to add new places and to modify existing ones.

- The application architecture is **open**, more options:
- connection to a database on historical heritage and reading of QR codes fixed in historical or other important locations
- following, both places and other users.

Further development should cover other locations, e.g. Vienna.

Conclusions and further development

The EPS methodology, concentrated on problem solving, emphasises the **teamwork** and **entrepreneurship** of the participants.

The successful educational process - the EPS method is useful for projects which assume a certain creativity and innovation.

A high level of identification with the team and the project: *"It was the opportunity (...) to meet people with another culture and way of working. Sometimes it was difficult for us to communicate and agree but we always found a solution to succeed. Living in another country, we learnt about ourselves too: punctuality, patience, responsibility and working in a team."*



Acknowledgments:

Both the team and the project supervisor would like to express our thanks to the EPS staff and teachers. First of all we would like to thank the Director of the International Faculty of Engineering, Lodz University of Technology, dr Tomasz Wolski.

Then we would like to express thanks to Grazyna Budzyńska, who provided us with necessary teambuilding skills, to Prof. Zbigniew Kołaciński, who wrote the review of our work. Finally, we are truly grateful to Joanna Auguścik, who coordinated the whole European Project Semester and answered questions on the organisation of the whole process.



Thank you for your attention!

dr inż. arch. Małgorzata Hanzl
mhanzl@p.lodz.pl

Students:

Antonina Młynarczyk
antonina.mlynarczyk@gmail.com

Alizee Tessier
alizee.tessier@gmail.com

Marcos Meiriño Munoz
marcosm3x3@gmail.com

Iban Micieces
ibanmicieces@gmail.com

Fanny Noirot
fanny.noirot@gmail.com



REAL CORP 2014

PLAN IT SMART__CLEVER SOLUTIONS FOR SMART CITIES 21-23 May 2014
VIENNA