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Hackmytown: an Educational Experience on Smart Cities

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Abstract. This paper describes the preparation and the execution of an educational experience consisting of a challenge, called Hackmytown, among five different teams composed by university students, aimed at experiencing challenges in the definition of "smart" services for a city. Glurns/Glorenza, the smallest city of South Tirol (Italy), was chosen as the ideal location to verify the application of the concept of Smart City in a small community by adopting a bottom-up approach involving local stakeholders and Municipality.

Keywords: Smart City, Educational Experience, Learning by Doing, People Centered Design.

1 Introduction

There is a growing interest in the "smartness" of cities, where -- as defined by the IEEE --, "a smart city brings together technology, government and society to enable 'smartness' in economy, mobility, environment, people, living and governance" [1]. The way to smartness thus requires a participatory, comprehensive and multidisciplinary approach, which in turn can be achieved only by specifically trained professionals.

The authors, as academics, have often considered that traditional educational practices aim at students' specialization in the respective disciplines. Consequently, academia prepares professionals that can only focus on their respective roles, and have little or no experience in interdisciplinary work and in participatory approaches. While a restructuring of degree curricula would provide, in the long run, a solution to these deficiencies, at present only an offer of extra-curricular activities may satisfy the

need for educating the future professionals, capable of creating and managing smartness in cities.

With such an educational aim, the authors have arranged an extra-curricular activity, which involved a group of university students from five different universities, in a workshop aimed at experiencing challenges in the definition of "smart" services for a city. Such an experience should: (1) exploit diversity in the students background (age, discipline, gender...); (2) provide an educational context, i.e. problems to be tackled can be understood by all participants, who should be able to propose sensible solutions in a relatively short time frame; (3) be expressed in terms of a "challenge" among teams, at the same time rewarding all those who engaged in the activity; (4) relate to society and governance, that is, provide an opportunity to address "real people" and contact "decision makers" of the target city.

In the rest of the paper, we shall describe related works, the preparation, implementation and follow up of the educational experience we undertook, that was called Hackmytown, and took place in December 2014 and in September 2015 in Glurns/Glorenza, the smallest city of South Tirol (Italy). Considerations on such an experience and on its possibility of replication conclude the paper: the possibility to port it to a wider audience where the attendees are citizens rather than students and the challenge is aimed at making them more and more aware of their active and participatory role, is also discussed.

2   Related works

The name "Hackmytown" explicitly recalls the "hackathon" experiences, which were a source of inspiration in the design of the activity, albeit in a peculiar way. Although many hackathons deal with coding, Joshua Tauber and other promoters of City Hackathons recognize explicitly that hackathons are just opportunities for creative problem solving, without a specific duration and number of participants, where people come together to solve problems, not necessarily involving technologies (see [2]). To this respect, Hackmytown falls in the above definition. The Urban Creativity Consortium of London in their working papers has given another classification of hackathons. Hackathons can be tech-centric or focus-centric; in the latter group, they identify socially oriented, demographic-specific and company-internal types of hackathons. Our experience falls within the socially oriented category [3]. Nandi and Mandernach [4] have recently outlined the importance of hackathons, as means for fostering informal learning. It should be underlined that while hackathons require to prototype a technological solution, our experience only allowed competitors (for time constraints) to present a "paper and pencil" prototype of the technological solution, i.e. to stop at the ideation phase of the hackathon. For this reason, our experience can be better related to educational literature on smart cities, rather than to hackathons.

The Smart City phenomenon spans many disciplines. Recent studies, conceptualizing the many dimensions of Smart Cities and the relationships between Smart Cities and their citizens, are for example those by Chourabi et al [5] and Arroub et al [6]. In many approaches to Smart Cities, education of citizens is considered one of the key success factors, and indicators of "smartness" for a city take

into account educational levels of its citizens (for a comparison of such indicators see [7]). The importance of approaches centered on citizens and their education within a Smart City has been highlighted by Giovannella [7, 8] and by Wolff et al [9, 10]. The former author has analyzed the importance of gathering citizens' perception of smartness, and the capacity of a smart citizen of self-fulfillment within the smart environment. The latter authors have identified in citizens' skills in managing Open Data the main educational challenge, and, in order to foster development of such skills, they have proposed an urban educational game in the form of "Appathon" (i.e. hackathon aimed at developing apps) to K-12 students.

3   Preparing for Hackmytown

During the winter of 2013, some of the authors participated in the Alpine Rendezvous ARV 13 that took place in the French Alps village of Villard-de-Lans. One of the workshops focused on smart cities learning, and used the same village as a case study in the design of smart city learning services [11].

The experience of Villard-de-Lans inspired the educational experience described in this paper. Mountain villages in the Alps still possess a strong identity, and the local community shares the perception of needs. It is also comparatively easy to share such needs with others, who are eager to listen to some locals. At the same time, the relatively small size of such a village makes it possible for citizens to contact with ease those responsible for the governance, without an excess of bureaucracy and intermediaries, as it would happen in larger settings. For this reason, a mountain village may be the ideal setting to host an educational experience on smart cities, which can be significant both for the learners and for the local community, without taking too much time, effort and intermediaries.

The choice of an alpine community fell on the city of Glurns/Glorenza, located in South Tirol, Italy, very close to the Swiss and Austrian border. As illustrated in public websites [12] the municipality is named "city" despite its relatively small population (about 1000 inhabitants), since it still lies entirely within its medieval walls. Agriculture and tourism are the main sources of income for locals, who share a relatively high standard of living, as it is common in a rich area, such as South Tirol. Compared to cities where hackathons have traditionally taken place, such as London or Washington, DC, the quantity of data involved in Hackmytown, and the sources for gathering information, were definitely smaller in Glurns/Glorenza. On the other hand, constraints on available time and maturity of participants (many of them university freshmen) suggested us to concentrate on a small city rather than on a larger one.

Through contacts made by colleagues of the Free University of Bozen-Bolzano, the only academic institution in the South Tirol area, a number of key stakeholders accepted to support the initiative and take part in it. Among them, the Municipality, and especially the Vice Mayor who supplied the main hall of the Municipality available for holding the meetings, and was willing for interviews before and after the event.

Other stakeholders who accepted to cooperate were the spokesperson of a local association for environment protection, and a tour guide and manager of summer

camping site. Both these citizens spent several hours with students, illustrating the location, its history, current issues, and future perspectives from the respective points of view. They both also took part in the final event. Finally, the (one and only) local hotel and restaurant was contacted, to ensure that all participants would be hosted in the same place, so to have an opportunity of informally meeting during evenings.

What was most difficult to arrange actually was the timing of the initiative. Being it an extra-curricular activity, it had to take place outside the regular academic calendar, which is not synchronized across universities. Such consideration left, as only possible period, the few days between the end of the teaching semester and the Christmas holidays, that is December 21-23. Considering that reaching Glurns/Glorenza (and going back to spend Christmas to the respective homes and families!) takes several hours, by private or public transportation, Hackmytown timings were carefully planned.

Finally yet importantly, the Faculty of Computer Science, Free University of Bozen-Bolzano included Hackmytown within its annual event budget, and provided funding for sponsoring the initiative. This way the Faculty granted accommodation and meals to all participating students.

Under these conditions, invitations were sent to several Italian and European universities using the network of contacts of the organizers. Teams of three students were recruited, under the condition that one academic should accompany them so to support the team, and to share own academic experiences in the "smart city" field with other academics and students. Many invitations were declined for the difficulties in arranging such an event outside the academic calendar. In the end, five teams joined in Glurns/Glorenza on December 21, 2014: those from the universities of Bozen-Bolzano (UniBz), Genova (UniGe) and Basilicata (UniBas), from the Polytechnic of Turin (PoliTo) and from Consorzio Roma Ricerche (Rome CRR). An expert from INSA Lyon who was available to support students' activities was also invited.

4   Running Hackmytown

One month before the event, participants received the text of an interview to the Vice Mayor of Glurns/Glorenza and local stakeholders, in order to have background information on the historical, economic and social dynamics of the territory of Glurns/Glorenza.

The event started in the evening of Sunday, December 21, with all participants getting together for a dinner in Glurns/Glorenza and then walking around the walled village. It should be remarked that free Wi-Fi is already available within the city walls, and that tourist services have been developed both by the municipality and the local operators.

Relevant activities started on Monday, December 22 with a guided tour of the city and its history since the Middle Ages. Then the two stakeholders presented what they perceived as greatest threats for the city future, and what technology, in their opinion, might do for its citizens.

Mr. A., the representative of an environmental association, explained the threats posed by the presence of car traffic crossing the medieval city, and mostly by global warming to farming. As opposed to diversification of crops/orchards, which was customary in the past, recently all farming has been based on just one variety of fruit, namely apples. Even if precautions are taken, an invasion of insects or a similar environmental threat may destroy the entire season's income for farmers who rely on a single product.

Mr. V., the stakeholder who works with tourists, clarified what in his opinion might be done, better connecting local farmers and artisans with tourist operators and with the tourists themselves. The unique urban setting attracts many tourists, who spend in Glurns/Glorenza just a few hours, but might perhaps wish to prepare the visit in advance, stay in touch after it, and meanwhile, be able to know what local products are available. Both stakeholders were available throughout the morning to answer students' questions until lunchtime included.

The true "hackathon of ideas" started in the afternoon, with each team independently working around possible ideas for a smart future city. Academics helped students to brainstorm and pick up some of the stimuli given by the morning discussions. This help was given not only to "own "students, but also discussing with other groups and colleagues about students' ideas. Then after a break students continued on their own, and academics presented briefly respective research topics, that could be applied in the "smart city" context, looking for possible interdisciplinary collaborations.

Dinner represented yet another break, while almost all groups of students worked towards refining their ideas and preparing a presentation for the next morning. Most activities continued in students' bedrooms and hotel common areas until very late during the night.

On Tuesday, December 23, the morning was dedicated to presenting the five ideas. Three of them will be summarized in the next section. Two separate Jurys ranked and assessed the ideas of the students: an Adults Jury comprising academics, local stakeholders and the Vice Mayor; and a Students Jury made by the students themselves. Besides participants in teams that were ranked at the top by the Jurys, all participant felt the experience as rewarding "per se" and were happy of the opportunity to do such an educational experience. Small symbolic prizes were given to all teams, and everyone rushed to the long journey back home.

5 The student ideas

In this Section, we report a brief description of the ideas of three teams, namely UniBz, UniGe and PoliTo. Unfortunately, the remaining two teams have not signed the agreement for dissemination of their proposals, so their projects are not described in this paper. It is worth noting that PoliTo Team won the Adult Jury prize and UniBz Team was considered the best project according to Students Jury.

We remark that most students were coming from urban areas, only a few from smaller settings comparable to Glurns/Glorenza, and just one (in the team of the local university) was already acquainted with the city itself.

5.1 Project by students from the Free University of Bozen-Bolzano

The students from the Free University of Bozen-Bolzano were a team of four, all of them enrolled at their first year of Bachelor studies. Two of them enrolled in a BSc in Computer Science and Engineering, and the other two enrolled in a BA in Design.

Their idea focused on the "identity" of the city of Glurns/Glorenza, which is unique in the area and on a problem identified from the interview of the local stakeholder, namely the underestimation of local patrimony.

Therefore, they proposed a 3-step solution:

(1) A new brand based both on a word "Olleweil" which in the local dialect means "every time" or "continuously" and a motto "Hintor insre mauorn" which means "within our walls", for linking all the manufactures in Glurns/Glorenza;

(2) The creation of some local branded selling-spots;

(3) The foundation of a cooperative, which can promote different arts and products.

They also devised a strategy for communicating such logo online and as stickers to be distributed among local business. The presence of the logo may be used also to foster synergies among local farmers and restaurants so to promote the "zero kilometer" culture in the area.

An illustration taken from the students' presentation appears in Figure 1, showing some potential icons belonging to the new Glurns/Glorenza brand.
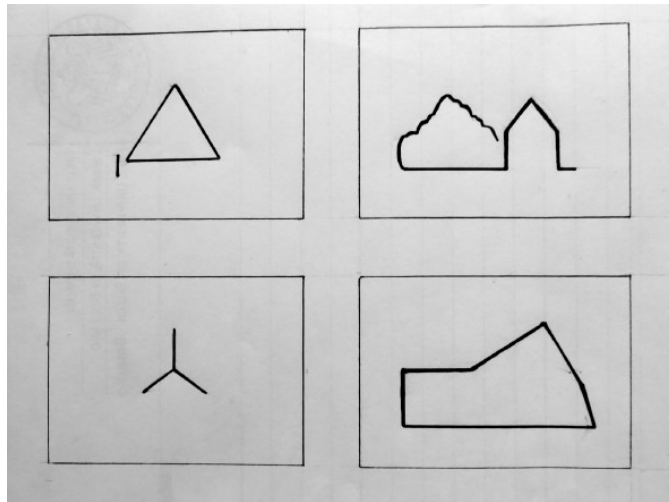

Fig 1. Some icons belonging to the brand proposed by UniBz Team.

5.2 Project by students from the University of Genova

Three students composed the team from Genova. Two of them enrolled in the BSc in Computer Science, and one in the MSc in Computer Science.

The core of their idea was to try to solve the apple monoculture problem by sensors, machine learning algorithms, and runtime verification techniques. In addition

to allowing the diversification, they observed that by using distributed intelligent systems it was possible to estimate the harvest time and consequently to aid farmers to manage efficiently part-time jobs. Even if the benefits were many (as the possible uses), the feasibility was high and the costs were not so expensive considering that sensors are cheap.
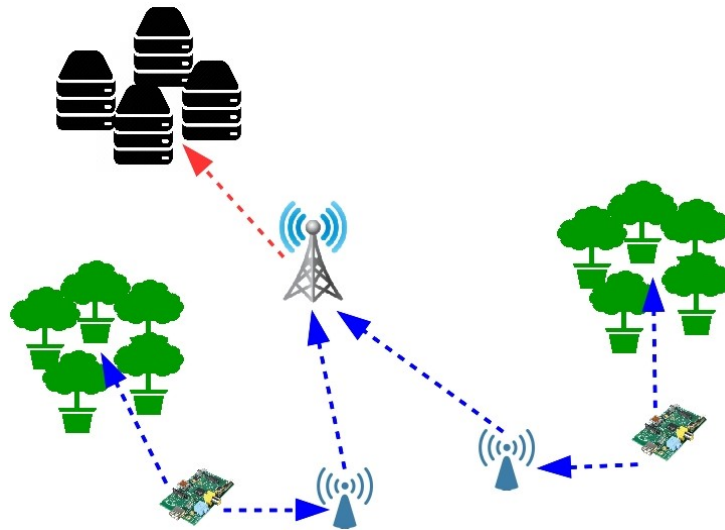

Fig 2. The distributed system proposed by UniGe Team.

The students also showed a preliminary design of a possible architecture implementation that is shown in Figure 2: the distributed system should recover data from plants (plants of any kind, not only apple trees). These data should be submitted (through wireless communication) to a centralized cluster where runtime verification techniques could check the compliancy of actual data with expected ones, and machine learning algorithms could be used to predict the harvest time, the plant health, and so on.

One of the most important aspect of their approach was the total preservation of Glurns/Glorenza thanks to the wireless communication between the inside and the outside of the city. This aspect was crucial for the inhabitants since Glurns/Glorenza is considered one of the most beautiful towns in Italy.

5.3 Project by students from Turin Polytechnic

The team of students coming from Turin was composed of three undergraduate students enrolled in BSc Architecture for Sustainability Degree. These students had previously participated in a similar experience, based on co-designing urban spaces with the collaborative support of the community (see a description at [13]). Their project idea was based on a more encompassing analysis of Glurns/Glorenza surrounding area and main features. Investigations were keen in having a grip about

the environmental, agriculture, climate, cultural, touristic and morphological qualities of Glurns/Glorenza. Some Italian best practices were discussed in order to see the degree of adaptability to the city case study. The initial survey on the field gave a hint about the city space quality and the community issues and aptitude.

Together with the Vice Major and other local stakeholders, it was possible to recognize a spatial engagement of citizens to the historic qualities of their center, of their agricultural habits and time routines, and of the retail connection to daily social activities.
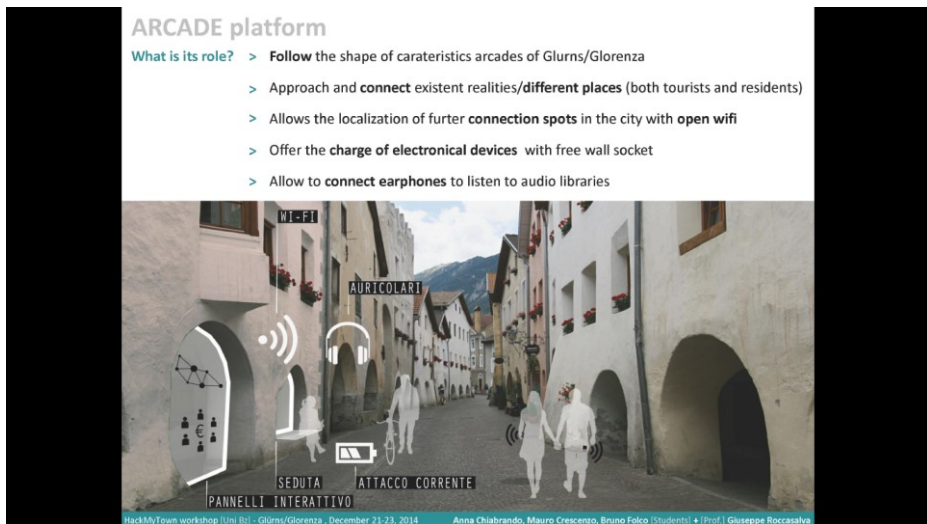

Fig. 3. The arcade platform proposed by PoliTo Team, an integrated urban service to charge electronic devices, to connect earphones, to connect tourist and residents by market place means.

The main idea was to make a new balance between traditional values and innovation in a small urban transformation. In this project, the surrounding walls of the city took a metaphoric and symbolic role. In particular, the project proposal re-designed the arcades of the city as a physical and digital strategy to regenerate the identity of this city and its community.

From an under-valued and abandoned space, the arcades become an integrated smart urban service space, with screens giving more liveable opportunities and economic challenges for Glurns/Glorenza and potential investors. Technologic arcades allow connecting virtually with other close towns and communities, giving the chance to people to relate, to tourist to be informed, and to the whole community to undertake common projects.

5.4 Assessment of students' ideas

Despite some overlaps between teams' expertise and backgrounds, the ideas proposed for the future of Glorenza/Glurns as a smart city were extremely diversified. This

applies first to the choice on what issue to focus, but also to the use of technological solutions that each team selected. It may seem surprising that one of the issues pointed out by the stakeholders as being critical (namely traffic) was not considered at all by the students. This may be due to the perception that this was not really an issue, considering the low traffic on Dec 21-23, which is outside the tourist season, and due to the urban background of many students, who are somehow used to the presence of traffic, and consider the city to be quiet enough and not needing improvements.

The Municipality of Glurns/Glorenza was enthusiastic about the workshop, and about how students approached the solution of some issues in Glurns/Glorenza, paying particular attention to the respect of the traditions and sensibilities of the inhabitants of Glurns/Glorenza. This clearly emerged in the Adult Jury's discussions, and in the Follow-up, which is described in the next Section.

The presence of two Jurys may suggest the possibility to derive explicit quantitative evaluations of the projects, since both Jurys ranked projects for the presence of specific qualities such as feasibility and suitability of the proposed ideas to the local reality. However, for the haste in which the evaluation took place, due to timing constraints, we feel it would be unfair to use such Jury rankings as truly representative of teams' performance values, given the aim behind the educational experience. In this sense, we were unable to assess the experience in a quantitative way.

During the experience, and especially towards its conclusion, all students expressed the feeling that the experience was "too short". Had a further half-day been added to it, students expressed a wish to compare the respective solutions, and cross-fertilize them with inter-group debate. On the other hand, diversity in age, gender, discipline, background, were all reported by students as positive values that Hackmytown was able to foster. Indirectly, this experience may also have decreased the *democratic deficit* [14] that several young people today feel towards participation in political decision making. Listening to citizens' opinions of perceived issues, and reporting their ideas to a Vice Mayor (who might eventually implement them) was new to most students.

Finally, at the time of writing this paper (that is, almost two years after the described experience) we interviewed again two of the participants, at the time being freshmen and now close to completing their BSc, asking them what they have "taken back" from the experience. They both remarked the importance of Hackmytown in their career, as a team activity, where solutions to real issues of real people were sought. One of them (presently a software engineer) highlighted the professional added value of having experienced an empathic "listening to" needs of others, rejecting the more superficial (but very frequent) approach of imposing general-purpose solutions to end-users.

6   Follow-up of Hackmytown

After the educational experience was completed, the Municipality of Glurns/Glorenza was renewed via elections, and then contacts proceeded between the local University and the renewed Municipal Council.

During Hackmytown, local stakeholders and the Vice Mayor were impressed by the creativity of all students on one side, and by the suitability of the proposed ideas to the local reality. This reflected into the invitation to present the ideas to a wider audience of citizens and tourists.

In fact, on September 20th 2015, in conjunction with the popular event "Days of Pala pear" in Glurns/Glorenza, the ideas proposed by the teams of students were presented in an exhibition by Dr. XXX (blinded for review) and some university students, assembled at GAP (Glurns Art Point). Many local citizens and tourists visited the exhibition, appreciated the ideas proposed and discussed with the students some of the problems related to their implementation.

A meeting with the Municipality was also planned to verify the implementation of the two winning projects. From the point of view of Glurns/Glorenza decision makers, the follow-up invitation is a clear sign of raised interest, and an attempt to promote democratic decisions on the (smart) future of the city. As remarked in [15], decision starts by formulating one or more decision models that reflect the decision makers' perceptions of the decision problem: in such formulation phase, the wider variety of opinions, the better for the next phases [16]. Students provided the Municipality with a very wide spectrum of diversified ideas, and the citizens will then have a wider choice among which to select next investments.

7   Conclusions

In this paper, we have reported the Hackmytown educational experience, which represented a unique extra-curricular opportunity for five groups of University students to gather hands-on experience on smart cities. In the design of Hackmytown, we have focused on promoting participants' acquisition of life skills, namely those that are indispensable for being a citizen in today's world. These skills are defined by the WHO [17] as follows: (1) decision-making and problem solving; (2) creative thinking and critical thinking; (3) communication and interpersonal skills; (4) self-awareness and empathy; (5) coping with emotions and coping with stress. In the description of the experience, and in the perceptions of participants gathered in interviews, the opportunity of exercising all life skills has been repeatedly underlined.

In the perspective of the local university, the Hackmytown experience represented a way to contact one of the remotest areas of the local territory, which can be reached from the university premises after two hours' travel. Students and academics from other locations were enthusiastic for having deepened their knowledge of a far-away yet beautiful and interesting alpine area. Some of them even came back during their 2015 holidays, to enjoy the atmosphere once again.

It is worth noting that the close cooperation with the municipal administration, local stakeholders and associations was the key to event's success. Nevertheless, to those wishing to replicate the experience elsewhere, we would recommend to enter into (as much as possible) a binding agreement with the Municipality, in order to define in details the possible implementation of the winning projects, or other follow-up means for future collaboration.

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