# Bringing Urban Design Site to Studio by using a Remote Surveillance Camera

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**ABSTRACT**
In architectural design, an architect understands the importance of the environment in the design. Especially in the city, where the changes in the built and natural environment are rapid and in the proximity, the site in relation to the design is paramount. Usually architects leave their studios to visit the building site in order to understand the amalgamation of the building to its environment. In this paper we present an experiment where the connection between the studio and the site is further strengthened by using remote surveillance cameras, a media database and projection technology. Using these technologies the site was brought in to the studio to gain additional understanding on how the changes particularly in the natural environment (lightning, weather, times of day and even the annual rhythm) affect the experience of the building site. Also the fitting of the new building to the existing environment could be analyzed.

**Author Keywords**
Architectural design, visualization, design studio, surveillance camera, design research, technology support for design.

**ACM Classification Keywords**
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

**INTRODUCTION**
The architectural and urban planning has always had a strong visual tradition. Architects' communication about the urban problems and their solutions usually bases on visual material. According to Langendorf [4] understanding complex information about planning and design may be greatly extended if the information is visualized. Visualization also helps to communicate with different participants during the planning process.

Designing can be understood as an interactive process, where the information arising from different stages (e.g. survey, analysis, concept, final design) must be tested against facts, goals and diverse issues. There must be a possibility to go back and forth between the planning stages as the designing process is cyclical. [2] Challenges in design can be seen as "wicked problems", the solutions are found during the progression of the design process. [6].

Architectural design is dependent on the building site, the sense of the place, "genius loci". The local elements, such as landscape, topography, vegetation, built environment and cultural aspects can be examined by the means of visual material. For example, a view seen from a photograph could be a starting point for the building design – to its dimensioning and scale.

The experiment studies new practices of design research, related to use of information technology in supporting communication between the users, designers and different fields of expertise in design. As the designers and users of a space do not necessarily speak the same (professional) language, we investigate how the users can – in a meaningful way – participate in the design of the space. In this experiment, the studio and the site and the interplay of the two in design are in focus. We aim to study what kind of information designers gather from the field (the site) and how this information is used in the studio. Our goal is to study whether technologies such as distributed systems, virtual models and simulations can support a more user centric design, and which properties of these technologies are important in this context.

### The design experiment

The experiment we describe here is related to two ongoing research projects, Studio'n'Site (studiosite.oulu.fi) and IPCity (www.ipcity.eu). The purpose of Studio'n'site project is to explore possibilities to use new information technology to bring site to studio and vice versa. The part of IPCity related to this experiment is studying how intelligent environment can facilitate participative urban planning. An experiment related to architectural design in cooperation with the Department of Architecture at the University of Oulu was conducted within a course for architectural design during the Autumm 2006. A group of five students volunteered to take part in the study. The experiment and the initial results of the study are described in this paper.

## THE ARCHITECTURAL DESIGN COURSEWORK

In the experiment, the students of architecture had a goal to design a group of dwellings. The area was located near the Oulu city center, in the upper left corner of the aerial image (Figure 1, marked ellipse). The area consists of the two shores of the bay to the south of the bridge in the northwest corner in the image. The city center starts from the lower part of the image to the southeast. Figure 2 shows the five lots 9-13 where the five students in the group designed their houses.

**Figure 1: Partial aerial view of the city of Oulu. (Source: City planning office of Oulu.)**

The of the design goals was also to take into account the neighbouring lots. In the designs, the group of dwellings should fit together with a common theme and the surrounding site in general. The designs should also consider how the houses, other buildings and the courtyard would connect to the nearby bay with a small boat wharf on the opposite shore. The designs should have a common wall against the road passing the lots to the northeast.

The connecting factors between the individual designs required that the students had tohave group design sessions, where the common themes, appearance of the wall and harmony between the design and the environment was to be decided together.

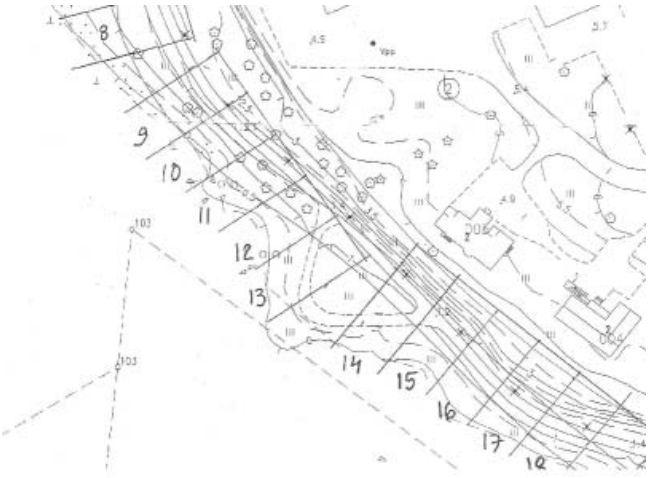


**Figure 2: Map of the area of design, showing the location of the five lots (9-13) of the five students in the experiment group.**

These group meetings were followed by a researcher from the project, who observed and made notes of the group discussions. The sessions were also videotaped and photographed for later analysis.

The students followed the usual practices of the course, instructed by the course teachers. The student group was facilitated with a simple technological system for bringing site to studio. We were interested to see, whether the tool affects or possibly changes the work at the studio. The following chapter describes the tool and the technologies behind the tool.

## TECHNICAL SETTING

Advancements in mobile technologies, such as mobile phones, wireless networks and locationing technologies has enabled us in communicating and conveying media and thus connect not only people but also places. The city of Oulu provides a free and open WiFi network for all to use in the city center and also in many suburban areas outside the center, complememting the mobile operators' 3G coverage.

We used Nokia PT-6 mobile surveillance cameras (Figure 3) to provide media from the site, and the Atelier distributed software framework for connecting system elements to each other. Additionally, a Hypermedia database is used to store the collected media from the site and enable the users to browse the media to be used in the architectural design.

The main functionality of the implementation in this experiment is to gather images from the site and relay them to the studio. The images can then used in the studio by the students of architecture in two ways. They can either project a continuously running slideshow on the wall or use a single or few picture to project them on a table with overlaying sketches.

**Figure 3: The Nokia PT-6 mobile surveillance camera used in the experiment.**

The slideshow presents a continuous "stream" of images from the site to the studio, thus enhancing the view of the designers of the site and especially the changing nature of the site. This includes the changes in lightning, both because of the changes in time (night, morning, day, evening) and changes caused by weather, for example. Since the experiment started in fall, continuing into the deep winter in January, we also experienced major changes in the site because of the changing of the seasons.

In addition to the slideshow, individual pictures can be browsed and projected from the Hypermedia database. This usually is necessary when the design is reflected against the site from a certain perspective or specific changing conditions, using one or several selected pictures.

### Technical implementation

As a basis for the implementation, a framework for distributed ubiquituous systems – Atelier Infrastructure [1, 3] – was used. In addition to the infrastructure, a hypermedia database (HMDB; also build by the University of Oulu in the Atelier project) was used to handle the media received from the site [3, 5].

### The Site

We used the Nokia PT-6 remote surveillance cameras to acquire the images from the site (Figure 4). The 1.2 megapixel cameras contain a GSM module, enable us to deliver the images automatically over GPRS using SMTP (simple mail transfer protocol). The camera was configured to send a certain number of pictures from a certain starting hour.

### The Studio

In the studio, the system comprises of three software elements. The Atelier infrastructure provides a framework for the system. This installation consists of three components, mediated by the infrastructure: an Email entrance service, the Hypermedia database, and a display component for displaying the media using a dataprojector to project images on the wall or on a drawing table. Email entrance polls an email inbox. It reads the emails from the PT-6 camera, and extracts the elements (text and attached images and/or video files) of the email. The elements of the email are then saved to the hypermedia database (HMDB). Header information (sender, date, time, etc) from the message is also stored as metadata in the HMDB. The metadata can be used in searching and retrieving media from the HMDB. The display component is currently a very simple interface to the hypermedia database, implementing the slideshow view into the collected media from the site, and users can also browse images.

**Figure 4: PT-6 image from the site towards west (not very urban view but this is actually a park close to the city center).**

## INITIAL ANALYSIS OF THE EXPERIMENT

The analysis of the collected data from the experiments is still going on but some preliminary comments can be made.

The images from the site proved to be useful in the group discussions. In the design of the wall a student mentioned that: "*…when you just look at those pictures, you cannot put any large walls there. That is, like, small things there, you cannot put a high fence or anything there, more like something suggestive, flat.*".

It was also found that the students wanted to use the acquired images for other purposes. A latter part of the course included using CAD tools to design an aspect of the building. The images can be used as background images in CAD models, leading to more realistic models of the site and highlighting the effect of the environment in the design. This extends the usage of the media from the initial sketching and discussing the overall design solutions to the detailed design process with exact computer based models.

During the process, it was seen that the technology must be flexible and adaptable with the evolving situation and solutions. For example, it would have been useful to be able to remotely control the cameras on the site or even to move the cameras in the site to other positions. The "mobile scout" idea in the IPCity project is another example of the need for mobile, place-shifting cameras. In the studio, various different projection angles and surfaces are necessary. In some situations the slideshow running at the background provides inspiration for design. In some other cases it is necessary to be able to project onto a sloping drawing table where the images from the site would be

overlayed with sketches of the initial design ideas (Figure 5). These requirements pose several interesting challenges to the technologies both in the studio and in the site.

Figure 5: Experimenting the projection of the images onto a drawing surface with a sketch.

## CONCLUSION

Initial experiences shows that our technology probe is feasible and it is has potential benefits for users. Even a rather limited quality images can bring some sense of a remote place to a design studio, and the possibility to browse a large selection increases the value of the facilitation. Although we were using a surveillance camera, sending of the images could have been possible by using an ordinary camera phone. This and the ubituitousness of camera phones is opening a new perspective to view a city.

### Challenges

Working in the field, especially in city, poses some challenges to research. There are security and privacy related issues that need to be solved, related to the surveillance cameras. Getting permissions for installing the cameras on public sites requires investigation, dealing with city officials and the police. It may be necessary to inform the public of the surveillance. Getting electricity and making a secure installation is not trivial, depending on the site. Designers usually appreciate good quality media. Current remote cameras do not provide high quality images. As mentioned related to the flexibility and adaptability of the installation, cameras with zooming and panning features and high image quality even in bad lightning conditions are required.

### Future research

During the experiment, there was several interesting ideas that were found that could take the simple technological probe further:

- Embedding virtual design models by projection into the image from the site, taking into account the source of lightning in the site image. This can be done using data like the time and date of the picture and the GPS location of the camera. Thus the model fits better into the image from the site, giving more realistic view of the design.
- Using multiple cameras for creating 3D views of the site, combining these 3D site models with 3D CAD models. Thus designers can then in the studio combine the 3D models of the site and the building.
- Remote control of mobile cameras in the site, to change direction, zooming of the view. Also live video feed with sound can enhance the experience of the site in the studio. In IPCity project, there is already an idea of using mobile "scouts" to collect media from the site and relay that to the studio.
- Presentation can be improved, e.g. with better browsing possibilities of the images from the site. For example, a designer would like to see all images taken in the evening from a specific camera towards some specific direction. A slideshow can then be produced for special effects highlighting some specific changes in the site (weather, direction of sunlight, for example).

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