

# Interaction Design Project Report: Group 5, pART

## Emil Bjunert

Applied Computer Science  
Chalmers University of Technology  
Kemivägen 7A  
41258 GÖTEBORG  
+46739838226  
emil.bjunnert@gmail.com

## Tim Brandin

Applied Computer Science  
Chalmers University of Technology  
Tyghusvägen 14  
41527 GÖTEBORG  
+46709670558  
tim.brandin@gmail.com

## Matthias Czaja

Applied Computer Science  
Chalmers University of Technology  
Tegnérsgatan 16a  
41252 GÖTEBORG  
+46735610445  
matticzaja@gmx.de

## Martin Schillström

Applied Computer Science  
Chalmers University of Technology  
Kemivägen 7A  
41258 GÖTEBORG  
+46736726538  
schillstrom@gmail.com

## 1. ABSTRACT

This report describes the group project named pART which was made during the spring of 2011. It describes the work done by the group members during the project; software and hardware solutions; methods used and the tests performed to come up with the final iteration of the project. This report also describes different ideas and concepts that were not implemented but explored during the course of the project. Finally goals are evaluated and an open discussion regarding the project is presented.

### 1.1 Keywords

pART, experience, palette, ubiquitous computing, tangible user interface, canvas, exhibition.

## 2. INTRODUCTION

This project is best describes as a public digital arts wall, and tries to incorporate three different techniques (TUI - Tangible User Interfaces, Ubiquitous computing and Lightness). The project is called pART, p for participative and art and the user will contribute with their part to the canvas. pART contains a participative infinite canvas, a spray-can, brush and a color palette to support the users creativity. Users can pan to their own space, or extend already existing artistic material on the canvas and be part of one bigger art project. The purpose of the project is to test the feeling of lightness and open for the context of installations at shows or fairs.

## 3. BACKGROUND

pART is the result of a group project in the Interaction Design Project -course under the Interaction Design master's programme at Chalmers University of Technology. The course description states the following; aims at a deepened understanding of central design issues in interaction design by means of practical training in design projects. In addition to creating working prototypes, the course contains lectures, exercises, and literature reading. A suggested but not forced theme to include in the project was lightness. The projects would at the end of the course be presented at Vetenskapsfestivalen in Nordstan during a weeklong exhibition.

The project group chose to focus on some key methods and terms such as tangible user interface, ubiquitous computing and lightness and with a focus on the exhibition as a context for the project.

### 3.1 Earlier ideas

The group was formed upon the idea to create a digital air hockey table, possibly using a Microsoft Surface as a technology base. The idea was to reproduce the physical interaction of an air hockey table game to a semi-physical digital media. This idea however got scratched early in the project process due to the clash with the lightness theme and also technical aspects such as only one Microsoft Surface was available and was to be shared with a master thesis project.

### 3.2 Tangible User Interface

Tangible is defined as the capability of being touched, and of being material or substantial (1). It describes items which are capable of being touched (e.g. cell phones) and on the contrary TUI are often describes as interfaces enhanced with interactive physical artifacts representing something usually on screen, or introducing real world items to the interaction. Or as Hiroshi et al. defines it (2): "TUIs will augment the real physical world by coupling digital information to everyday physical objects and environments."

### 3.3 Ubiquitous computing

Ubiquitous is defined as being constantly encountered or everywhere at the same time (3), and the term Ubiquitous computing was coined by its founder Mark Weiser (4) to describe a future in which invisible computers, embedded in everyday objects, replace PCs. The most prominent social impact of ubiquitous computing is that it promises a removal of the traditional PCs, where we at each day spend a ghastly amount of time. Introducing ubiquitous computing could save a lot of people from getting the common neck, arm, eye and hand related problems as mentioned a big problem by Lasa (5).

### 3.4 Lightness

The lightness theme could be interpreted in many ways, during the course of the project several different definitions and interpretations were presented by the group and fellow group members. One is the sustainability take of the theme, another one is the feeling of lightness, and both will be described below. The group chose to focus on the feeling rather than the sustainability take.

Regarding our project we interpret lightness as a feeling. That means the users will not experience any consequences regarding their actions. For example, using a real spray can with real spray paint will cause a penetrating smell and potentially a mess when it's not used correctly. Using our spray can in combination with the system in comparison, will not cause any of those drawbacks. Thus, the user feels free ("light") while using our spray can, since there are no negative consequences to be afraid of.

### 3.5 Related works

As mentioned earlier our project is to some extent based upon a related work made by Johnny Lee (6). Basically what he did was to map a Wiimote and IR-light to a computer mouse and with help of a projector creating a Multi-point Interactive Whiteboard. Please visit Lees website for more information on this project and watch his short movie on how everything works.

Another inspirational project we found was the WiiSpray (7) which differs a bit from Johnny Lee's project. What they did with WiiSpray was to fully modify a Wiimote - hacking it and putting it inside a spray can. They do not say much on how they implemented everything on their web page, but we got some ideas from it - especially on where and how to put the IR-laser in the spray can. This project also made us try to not do the same project as WiiSpray again and instead focus on other aspects, such as the endless canvas.

### 3.6 CONCEPT

The exhibition description of our concept read as following: "Get the feeling of traditional painting with a technological twist. pART is a project that contains a participative infinite canvas, a spray-can, brush and a color palette to support your creativity. Pan to your own space, or extend an existing art piece and be part of a bigger art project."

The pART concept sprang from a idea generating session in which the group finally came up with the idea to create a digital interactive painting surface. Before settling on the final concept presented at the exhibition the group had some different ideas and inspiration that will be presented below.

During further discussions features and tools were added such as the spray can or the color palette (see REALIZATION). However, during the concept development phase we got inspired by tutorials, especially regarding the Wii Remote projects, of rapid evaluator Johnny Chung Lee (6) we found after some research.

Also, we were aiming a certain additional value that would distinguish our concept from similar existing projects. One interesting value we decided to work on was the time aspect. The user was supposed to travel back and forth in time to discover the artwork that has been created by others.

Unfortunately, we did not find an adequate way of implementing this aspect into our concept, which is why we kept generating ideas and came up with the feature of an infinite canvas. Participants have unlimited space to do their art piece. Thus, users will work on one big constantly growing art project with other artists, rather than doing a project alone. Based on this feature

decision we had to face problems regarding the interaction, which means that functions and concepts for panning and zooming across the canvas were required (see REALIZATION).

We have also paid quite a lot attention to the user experience design during the development phases. It was always in the main focus when it came to different interaction and software concept decisions, since we wanted to generate a certain user experience that will be explained more in detail in GOALS.

### 3.7 GOALS

During our design process we determined different goals which we divided into two categories:

#### 3.7.1 Main goals

- Fitted for exhibition
- Endless canvas with tools
- Product appearance

#### 3.7.2 Experience goals

- The user should feel:
- In control
- Motivated
- Have fun
- Free Expression
- Hip and cool
- Smart and cultivated
- Traditional painting

## 4. METHOD

The method the group used for conducting this project was iteration-based. In the first couple of weeks the group met for some ideation sessions, where ideas were spawned, discussed and either approved or dismissed. Furthermore when we had an idea we did some quick research about it in order to see if it was possible to do.

When the group settled for the idea which later became pART we started to plan our work and divide into different areas, so each one of us had an area of responsibility. Next step included crafting prototypes; from paper prototypes to experience prototyping and also some wizard of oz-style testing. For each prototype we mostly tested it ourselves but we also made some user tests on at the moment nearby and available classmates.

## 5. REALIZATION

The most time demanding part of this project was the realization of the various entities of our project. Evaluating the setup with Johnny Lee's program made a good starting point, which ended up in discovering its potentials for further development. In the picture below you can see how the setup works:

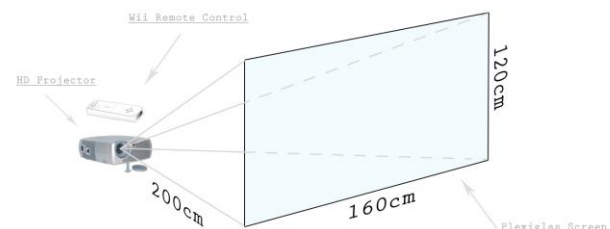


Figure 1. Setup of projector and screen

When the method for mapping the IR-lights to screen-space was decided the group started to work on the physical entities.

## 5.1 Brush

The brush went through three iterations before the final result were settled upon. The first basic prototype consisted of just one IR-LED and one 3 Volt battery. The second iteration contained a real brush with the same IR-LED but with a different kind of battery and a small push-button, in order to turn the light on and off. With the third iteration a decision was made to use a laser instead of an IR-LED in order to get a brighter spot on the backside of the screen - making the draw part more reliable. With the third iteration the push-button was moved behind the lamp and thus making it touch sensitive opposed to pushing a button with your finger in order to lit it up.



Figure 2. First prototype of pen/brush



Figure 3. First iteration (With button)



Figure 4. Second iteration (brush)



Figure 5. Third iteration (brush/pen)

## 5.2 Spray can

The spray-can also went through three iterations whereas the first one consisted of a spray can, a push button and an IR-laser. This first iteration was all about getting the feeling of how it was to hold and work with a spray can. For the second iteration we included an Arduino Nano, ultrasonic distance sensor and a Bluetooth module - the thought with adding these components was to make the brush size bigger the further away from the screen the can is held and pressed. With the third iteration we actually went for a metric with four IR-LED:s since we had threshold problems with the ultra sonic distance device, but also the metric gave better light resolution thus making it easier to paint with.

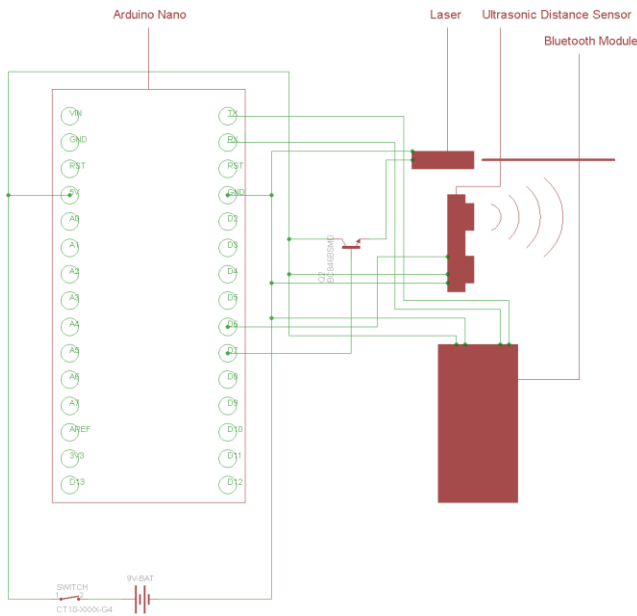


Figure 6. Schematic over spray can circuit



Figure 7. First iteration

### 5.3 Palette

For the palette we made two different iterations, the first one was very quick and cheap made out of cardboard, one Arduino Nano, a Bluetooth module, some white LED:s and a couple of reed relays. From the first prototype we made some really useful findings - like the fact that it should work equally good for left-handed people as for right handed. So for the second iteration we

fixed the problems we found out and made it a feast for your eyes - made out of plywood and some nice looking colors and the same types of components as in the first iteration.

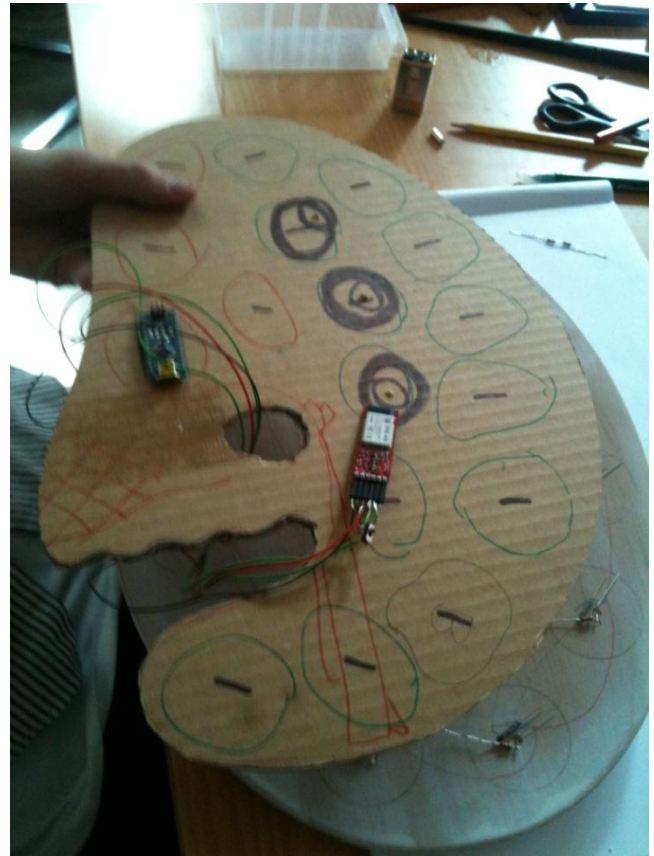


Figure 8. First iteration



Figure 9. Second iteration

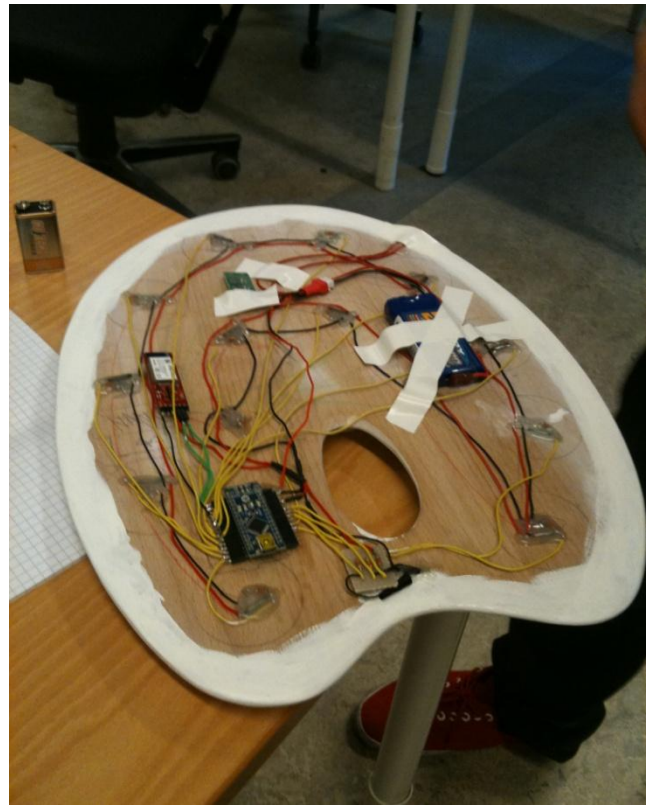


Figure 11. Final iteration, backside.



Figure 10. Final iteration, front side.

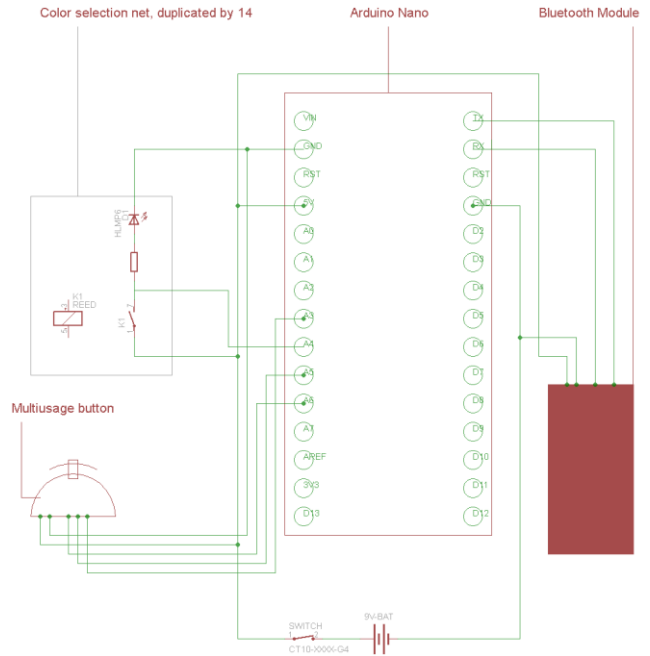


Figure 12. Schematic over palette

## 5.4 Painting application

Development of our painting application required numerous iterations before the final version, due to new requirements experienced each and every time a testing session was done. The first iteration had Bezier curved lines following the mouse strokes. Second had improved spray simulation and in the third iteration we built the unlimited canvas. Fourth version worked together with an external server application enabling hardware

communication in flash, to get data from the palette and spray can. The most interesting feature namely our “spray painting”-feeling required a part of the group to do an experience prototyping session before they could understand the feeling, to be able re-create it in the digital canvas.

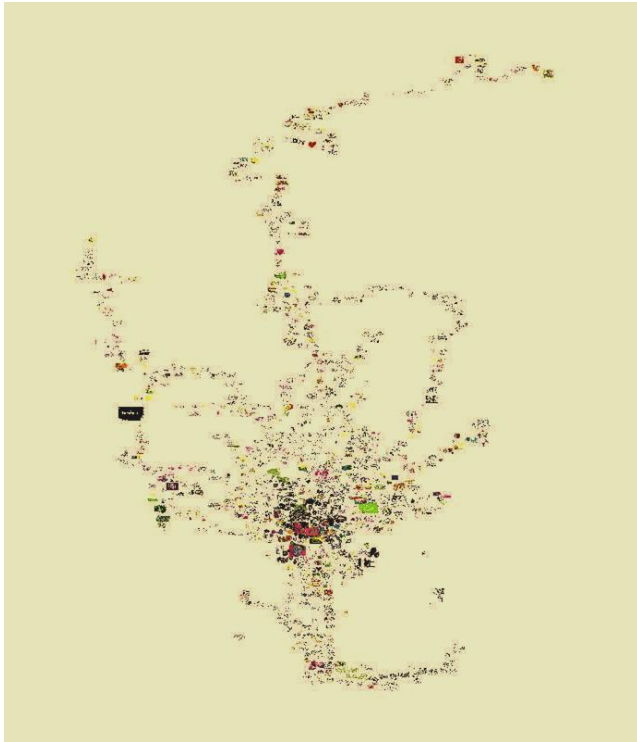


Figure 13. Overview of complete artwork from Nordstan

## 6. EVALUATION

The project and the project group had three main goals; do a design fitted for an exhibition, keep the simplicity of the original idea and to realize the concept as what exhibition visitors would consider a product.

### 6.1 Exhibition

The exhibition goal should be considered a success based on the feedback from the exhibition itself. pART almost always had a crowd and someone using it. The comments from people passing by - be them children, old people or even fellow interaction designers - were overall positive. The fact that companies showed interest in the project is also something that would confirm the success.

### 6.2 Original idea

The original idea, or final idea, was to create an infinite canvas that should be filled and expanded during the exhibition with provided tools, which should give the users something close to a wow-feeling and to feel like he/she is a part of something bigger than just his/her own work. We did manage to produce almost all the technical aspects needed for this and this goal should also be considered met. However since the zoom did not work during the exhibition week most users had some trouble understanding that the canvas actually was one big piece that never got deleted/blanked. Based on the “aha”-comments we got when showing the not fully working zoom function for a first time user we could assume that this would have helped with mediating the endless canvas concept.

## 6.3 Product appearance

Our tools we have developed and created during this project were supposed to look like actual products rather than prototypes. Therefore, we paid a lot of attention and time to the appearance and design of our tools. The tools got several layers of white spray paint and a clear coat to achieve a nice glossy effect. Furthermore, the different colors on the palette are represented by little color splatter made of acrylics.

## 7. DISCUSSION & FUTURE WORK

“A good user experience satisfies the needs of its makers. Otherwise there is no incentive to maintain or improve it.” (8). The group is unified in the meaning of this quote; that you really have to like your own project in order for it to be successful. We believe that is the main reason why we, as a group, choose to work with pART. For us this is the core for making a project, even more important than following design principles and having a well-structured plan. We still agree that without a good plan and design principles the project would most likely fail but without no heart it would have died anyway. In order to make a good project including a good user experience you will have to find a path that brings together these two components.

### 7.1 Feedback and findings

The group is very proud of the project and as far as the feedback we got from the people who tried it out they all seemed to like it very much. For instance parents had trouble getting their kids away from our stage - they wanted to paint more. Other people came back at several occasions stating “I really need to try it again, it was so fun”.



Figure 14. A lot of kids trying pART.

People really saw the benefits of having this interaction type in many different contexts, far more than we could ever have imagined. And they we’re interested in us not only personally hiring us but knowing more about the project and would like to invest in it if we had chosen to continue with it.

One interesting finding during the exhibition was that Graffiti-artist came and did their artworks and tags even though we thought they might have difficulties performing on a public stage where they can be viewed and get identified together with their tag. One comment we got from a graffiti-artist regarding the above mentioned situation was that: “pART is a great medium for them to perform somewhere else instead of painting on trams”, but he did warn us not to take any names and personal data just to

let everyone paint and if they want they should have the possibility to tag themselves.

The final stable version of the application found it's place in the end of the exhibition week, thanks to many creative and fun improvement suggestions discovered by us and testers during this time, that we just had to implement these during the evenings and nights following each day.

Together with another project "Social Locale" (9) who was doing a check-in service with Facebook, we collaborated and during one day rebuilt the system uploading pictures to Facebook to also deliver the latest photo on their screen.

During one day we set up a live stream to the web where people could see in real time what was painted on the canvas. Thanks to this success the following day we had a web cam showing the artists painting live on the wall instead. In total the stream delivered two thousands minutes of material to watching users, while having an up time of 15 hours for these two days.

We choose not to have widgets on screen which is the norm, because of its cluttering side-effect, taking up screen-space and interfering with the currently shown artwork. Therefore we decided to build physical artifacts and a tangible user interface.

## 7.2 Appearance

One conclusion we could draw from the above mentioned observations is that appearance and first impression is really important when it comes to exhibitions. The window of opportunity is within a few seconds that open for the people passing and decides to stop and look, which is one of the most important things to aim for an exhibition/show context. We feel like we managed to succeed quite well with this based on the general feedback and audience that we had during the week. A possible future work would be to really probe why people do this with our project and try to amplify this effect even more, and also to get more accurate user population statistics. Farsa

One of our goals was to present, or wrap, our idea within a product like appearance so that the people would get the impression of a professional and working thing, ready to use. We did by placing our logo on almost all tools and also to try to get a matching look on all parts, from the brush to the canvas. Our visual theme was white and shiny, mainly and loosely based on the lightness theme. The hardest part was to make the screen/canvas to fit with this, but the solution to make it almost floating in the air was according to us and fellow students was a good choice. When we removed the screen from the frame used by previous years project we immediately saw a big change in the appearance. The screen went from looking bulky, unprofessional and sending out signals of a work in progress to something much more clean and professional. The reason we did this was to mediate the simplicity of use to the users and by passers.

## 7.3 Future work

During the exhibition, as previously stated, we encountered a lot of people who really enjoyed our project. Some of them suggested future possibilities and job opportunities where the context could be anything from exhibitions, events, art shows, car shows and museums. The group also got some enquiries about possible installations at kinder gardens, boardrooms and children hospitals. So for now we are just waiting to see if any of these companies or contacts are serious about what they commented during the exhibition. If they are we need to make some adjustments regarding some parts of our project; for instance the spray can requires a wider painting angle - which means LED:s need to be mounted in angles so they create a wider shine of light to cover

the "swipe away"-movement which a lot of people had troubles with when they first tried pART.

As for the palette it does not need that big of a change, one of the things that needs to be done is to make the bottom more robust - especially if kids are going to use it on a daily basis. Another adjustment to the palette is to make the battery easy to access and change, so you can charge at least one battery while the other one is operating in the palette.

The brush needs same kind of upgrade similar to that of the spray can, enabling tilted angles while painting. One possible solution could be to use an IR-source where light spreads somewhat close to 180 degrees.

Furthermore the program needs small adjustments regarding optimization, but also what we could do is to implement the program in a specific way - as a future customer might want it. One interesting finding was that we incidentally used a two year old version of the Wiimote-library (10), the new one could easily implement multi-user input and enable larger size screen or multi-screen. This would in fact make pART even more interesting to work with in our opinion.

## 8. CONCLUSION

The project turned out to be a huge success exhibition-wise with a great deal of positive feedback from audience and people evaluating our design. The exhibition aspect was one of the things the group was aiming for with the realization of the project. And if we are lucky it might end up with a company building installations.

## 9. ACKNOWLEDGMENTS

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