

# CYCLECIRCUIT

A smart bicycle bell that stimulates children to cycle

Eindhoven University of Technology, Bachelor College Major Industrial Design



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Sports

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B1

Coaches: P.J.F. Peters and S.I. Lucas

Tutor: T.F. Kervers

V. Broeken 0940695

E. van Doleweerd 0942132

J. van der Heide 0942989

T.M. Hendriksma 0959147

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# FOREWORD

Before you start reading this report, we would like to mention something about personal issues within our group. Due to personal problems of Tyana Hendriksma, one of our group members, we faced major difficulties in our teamwork. This means that we did the main part of the project with three, instead of four people. This also influenced the group communication and planning for the rest of the group members. Nevertheless, we are proud of our project and the way we learned to handle these difficulties.

Please enjoy reading.

Sports Group 1

# INTRODUCTION

This report is a paper about a design project about sports, part of the study Industrial Design at Eindhoven University of technology. We worked on this for around half a year and in this report you can read about our concept, how we achieved this, and what we learned in the process.

In modern day society, lots of children have swapped the adventurousness of playing outside for the convenience of the game console, laptop smartphone or tablet. And that's not all. According to recent research<sup>1</sup>, obese amongst these children is way higher than it should be. With this in mind, we started developing the Cycle Circuit.

The Cycle Circuit is a device that is developed with the goal to make children play outside more. It is in essence a smart bicycle bell that sets challenges for the user with upgraded ring sounds as a reward. Points we focussed on while designing are exploration, stimulating creativity and competition.

Before the game starts for the children the parents can view a map through a platform. On this map they can set their neighborhood boundaries and add specific points/tasks. For example; pass a speed bump twice, search for a specific street light, go over a certain traffic sign or go three times around a roundabout. Parents can connect the device to a computer, through a USB-port. The children

will only receive the task within the set boundaries. The children themselves can also add new points/tasks. They can do so by exploring the neighbourhood and pushing the button on the device when they discover new interesting tasks/place the task on the platform.

On the platform an introduction video is provided. This video will ensure that the children understand the essence of the game. It shows that they have to explore the area and look for tasks. They have to cycle through their neighbourhood and they get feedback when they have com-

pleted the task. Like this they receive points and eventually go level-up when they have completed the tasks.

Then the exploring starts. The child puts the gadget on his bike and starts cycling through the neighbourhood. When children cycle around, they get feedback when they have executed the task, which is connected to a specific point. They receive points and nice comments when they have completed the tasks. After earning a certain amount of points they get onto a new level. A new level means a new bell-sound, which can vary from a bike bell to a steamboat horn.

This is all realised through a a GPS system, this can be used to obtain locations. Specified locations can be found while being within a certain area of the location. A point will be received, which is shown on the next features: a LED-ring and the audio-output. This LED-ring can show the progress through putting lights on and off. An audio output can provide sounds when a new level is reached. The sounds can vary from a bike bell to a steamboat horn.



# PROJECT GOALS

The **Cycle Circuit** is, as described, a gadget to provide children an outside adventure. Through this gadget we want to achieve that children start cycling more in a **playful and explorative manner**. We strive to let them enjoy it and start seeing it as entertaining and not an obligation.

Our goal is to achieve this through **stimulating creativity**, letting children discover their neighbourhood and finding new spots. When they are getting to know their area, and discovering new places to play. They will be more likely to go there and play outside more. Our ultimate goal is to **make children enjoy playing outside more!**

During this project we have several goals, which are not specifically related to the concept, but to the teamwork and our Personal Development Plans. One overlapping personal goal is learning **how to work with electronics**. This is why we want to divide tasks around this topic.

Goals related to teamwork are that we will communicate clearly, divide tasks in a honest manner, have productive meetings and a clear overall vision. Also, we know it will not always go easily and as planned, but we will talk about it as a group and **reflect on how we work as a group**. From this reflecting we can learn, change it for continuing the project or for other projects.



# PROCESS

In this chapter, we will discuss the progress we went through during this

We started the project together with searching for usable ideas. To generate these we tried different brainstorm methods, among others; traditional brainstorming, making lists and thinker-toys animal brainstorming. We had different ideas, we had difficulty choosing something and using that idea to continue.

What we did know, was that we certainly wanted children to be our target group. We wanted to motivate them to play more outside. We also got some input from a children's physiologist, who told us the benefits of cycling for young children. For this reason we decided upon the idea of motivating the children to cycle more. At first we thought of designing a new bike, but later we thought that a gadget for on the bike would be cheaper and easier.

We bought two bikes to do user tests and to see what kind of gadget would fit well. The user tests were very useful, we got a lot of new insights from the children. For form-studying we made a lot of pictures of different object on the steer of the bike, which was help-

ful to do, we could see easily what kind of form we considered to be the best for our concept. Gradually our concept became more clear and we started with the electrical part as well, which was difficult. The GPS system did not work directly. We needed the system for new user-tests and for designing the prototype. Due to these difficulties, everything delayed a bit.

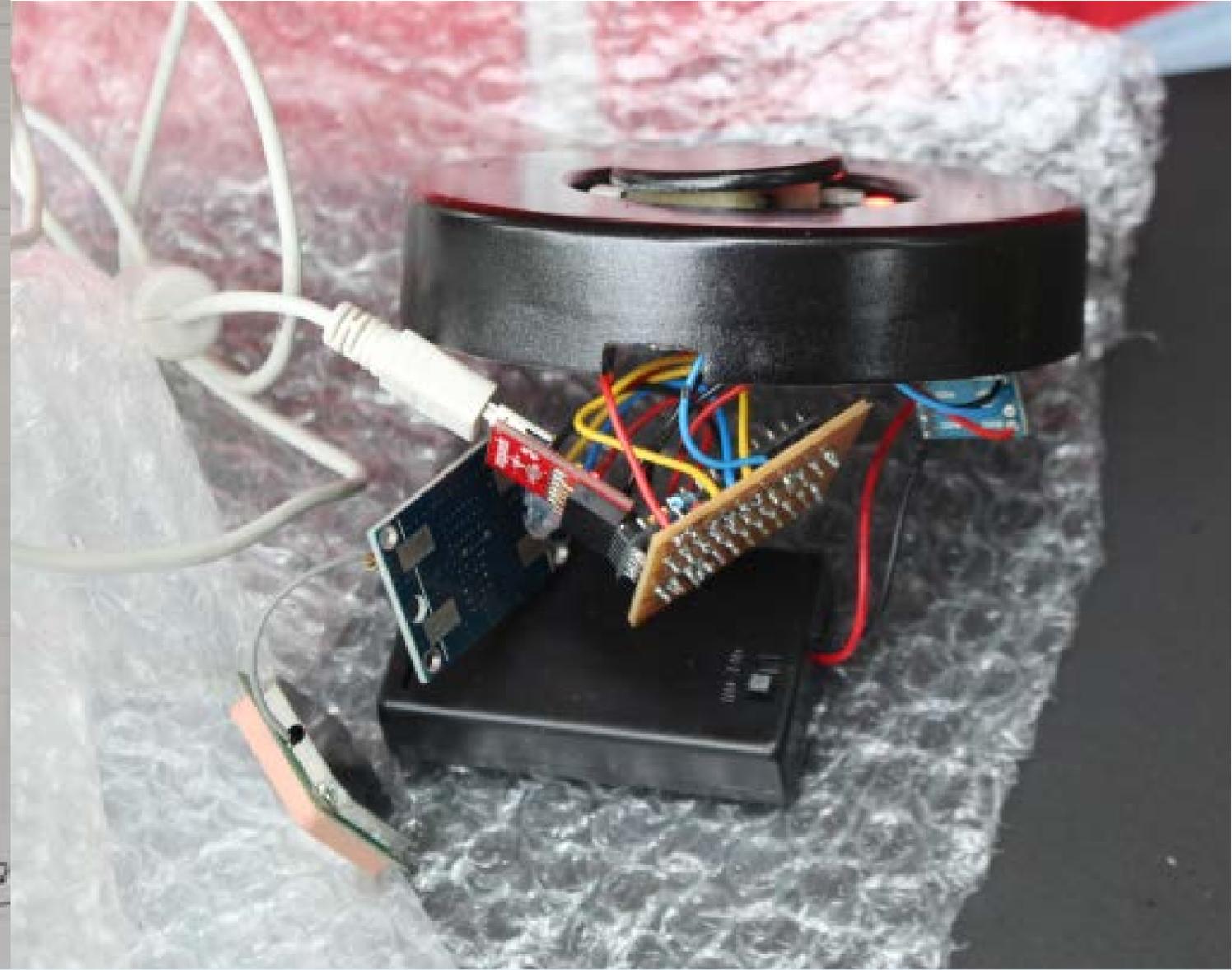
Because we had to make progress fast, we tried to work more efficient. We made a new planning and we switched tasks to be more productive. This way everyone in the group was able to improve their skills for using electronics and programming. We also made the concept more clear. We wanted to have the possibility for the children to add new challenges, to keep the device safe, to change settings and to have a social aspect as well. That is why we decided that we wanted to have a platform connected to our device. So at this moment, we started developing it.

We finally got the GPS-system working and were able to start programming it and to connect it with the other elec-

tronics. Regularly some of the electronics did not work anymore, it cost us lots of time to discover the reason behind it and to change or repair things. But finally we succeeded. We got the GPS working with light feedback (through a LED-ring) and a push-button. Also, we were able to measure distances and we could import the coordinates we

wanted in the program. We had more difficulties with the sound feedback. We did not managed in getting the sound loud enough, for this we needed an external speaker and more external power. We did not had enough time to manage this.





In the meantime, we started on developing the online platform. By looking at similar platforms and some literature research, we came up with a basic structure. Then we decided that the core functionality had to be to add challenges to the community and that tweaking device settings and stimulating social interaction through a ranking list would be other major aspects. Since none of us had any experience in web design, this took some time to do right, but we were able to implement all the functions we wanted in some way or another.

For the finishing, we made some designs and discussed for a smart way to put the device easily on and off the bike. Furthermore all electronics had to fit inside, with battery's (we wanted it to work without the computer), and we had to see where we wanted to have the LED-ring and the push button. We knew that we could not manage in making the prototype very small and with the features we described in our future plans, but we made a nice design and spray-painted it smoothly, on a way that you could not see that it was made out of wood.

We wanted to do a last user-test with the working device, but when we were able to go, the device did not work correctly any more. Luckily we managed in doing this last test the day afterwards, and we filmed it to make a nice video for presenting during the Demo Day. For our presentation, we were not able to show the working GPS-system, because this did not work inside the building. So we decided to show the system with the light feedback. We also made a little sound-feedback with piezo elements. We worked out the platform well, this

was interesting to show at the Demo Day. On the basis of this platform and the gadget we could explain our concept. Besides those things, we had three different posters and a board for feedback, which was really useful. We presented all together, we were really satisfied about our result and we were motivated to pitch our idea to others.

# ITERATIONS

During our process we went through several iterations. This is an overview of our ideas and how we found them.

## Iteration 1:

A bike that will show cycled kilometers through accessories. When more accessories are visible, more kilometers have been cycled. Children will be able to choose their own favorite accessories. Basically this meant that your bike becomes more cool / beautiful the more you cycle. We wanted to stimulate in a playful yet competitive way. They should not think about the cycling itself; it should become

a mean to a reward.

After a brainstorm session and thinking about what children enjoy, we came up with this concept.

We dismissed this idea after a little over a week. Although we still really like the concept, we couldn't come up with a solution to make these "transforming accessories". We wanted to create a similar motivator, but a little less complicated.

## Iteration 2:

It is a gadget which can be attached to a bike. It receives specific points through Google Maps. With a GPS system it finds those points and through a yet to determine interface challenges will be provided. It needs to be attachable to the steering wheel.

The idea behind this iteration was that

we wanted to add competitiveness as a motivator, but we also wanted to stimulate creativity and exploration by means of this concept.

We came up with this after brain writing and several brainstorm techniques.

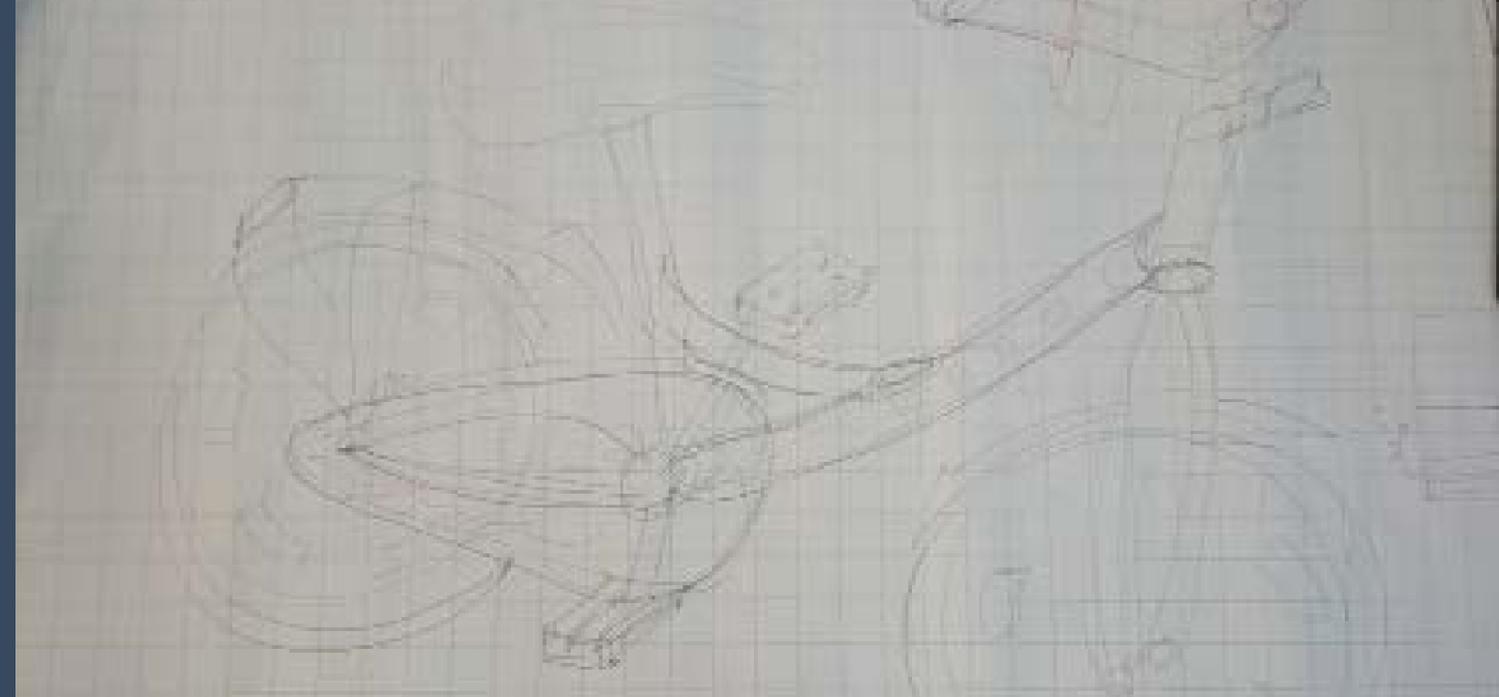
We saw possibilities in this concept, so we decided to work it out some more.

## Iteration 3:

It is a gadget which can be attached to a bike. It receives specific points through Google Maps. With a GPS system it finds those points and through a voice the spots can be found. The voice also provides the challenge to be done. Whenever

a task is fulfilled a sound is generated in the device.

This is a step further than our previous iteration. We also thought a bit more about safety, so the main goal here is to add safe and clear feedback to our idea.



## Iteration 4:

This concept takes the game idea a step further. Using a built-in camera, kids can also do challenges like “pass a certain traffic sign” or “photograph a tree”. This adds even more challenge and opportunities to explore, the goal here being to make the device more interesting by adding options.

We came up with this after so exploratory

sketches and talking / brainstorming about ways to make the device more interesting. The first user test we had also helped out in realising we could make some more challenges available.

We dismissed this idea due to the lack of decent software for recognizing objects in pictures, as well as high cost and product value (in case of theft).

## Iteration 5:

For this iteration we thought more about functionality, interaction and several side functions. The web interface is a new concept here, with the ability to let parents set a ‘safe region’ for their kids to play in.

Besides audio, we also implemented LED feedback, and a NFC chip for short range interaction between devices and wireless charging.

One of the things that really changed here was the idea of rewarding. We now came up with the idea to reward kids with different sounds for their bell.

We came up with this after more mind mapping and using several brainstorming techniques.

Pretty soon after we came up with this idea, we dismissed some features. The parental control based on GPS we wanted to use is maybe a bit privacy sensitive. We also discovered that NFC has too short a range for connecting two devices on two different bikes, and that the wireless charging was totally unnecessary due to the low power cost of our device. We really liked the change-sounds idea, so we stuck with that.

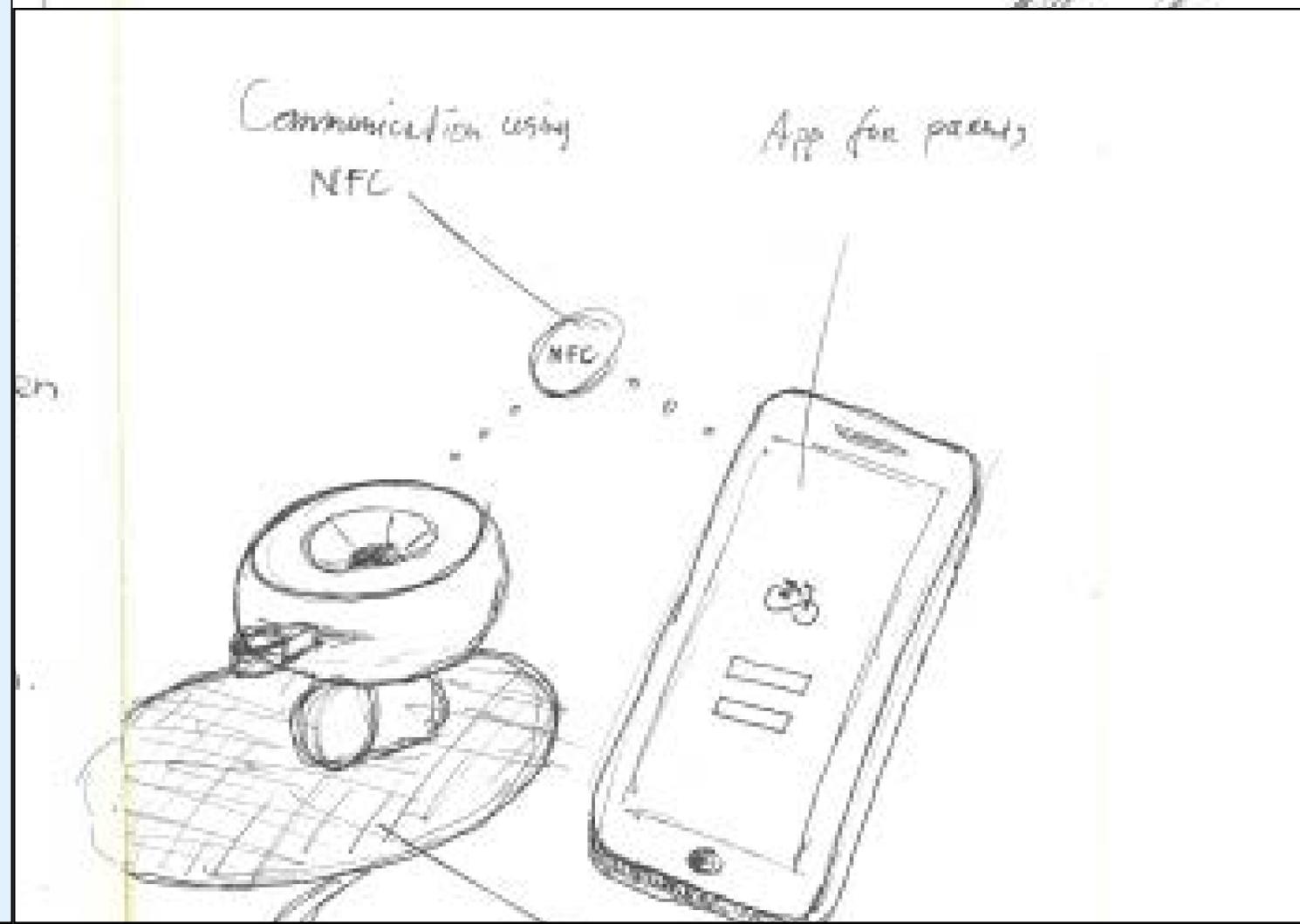
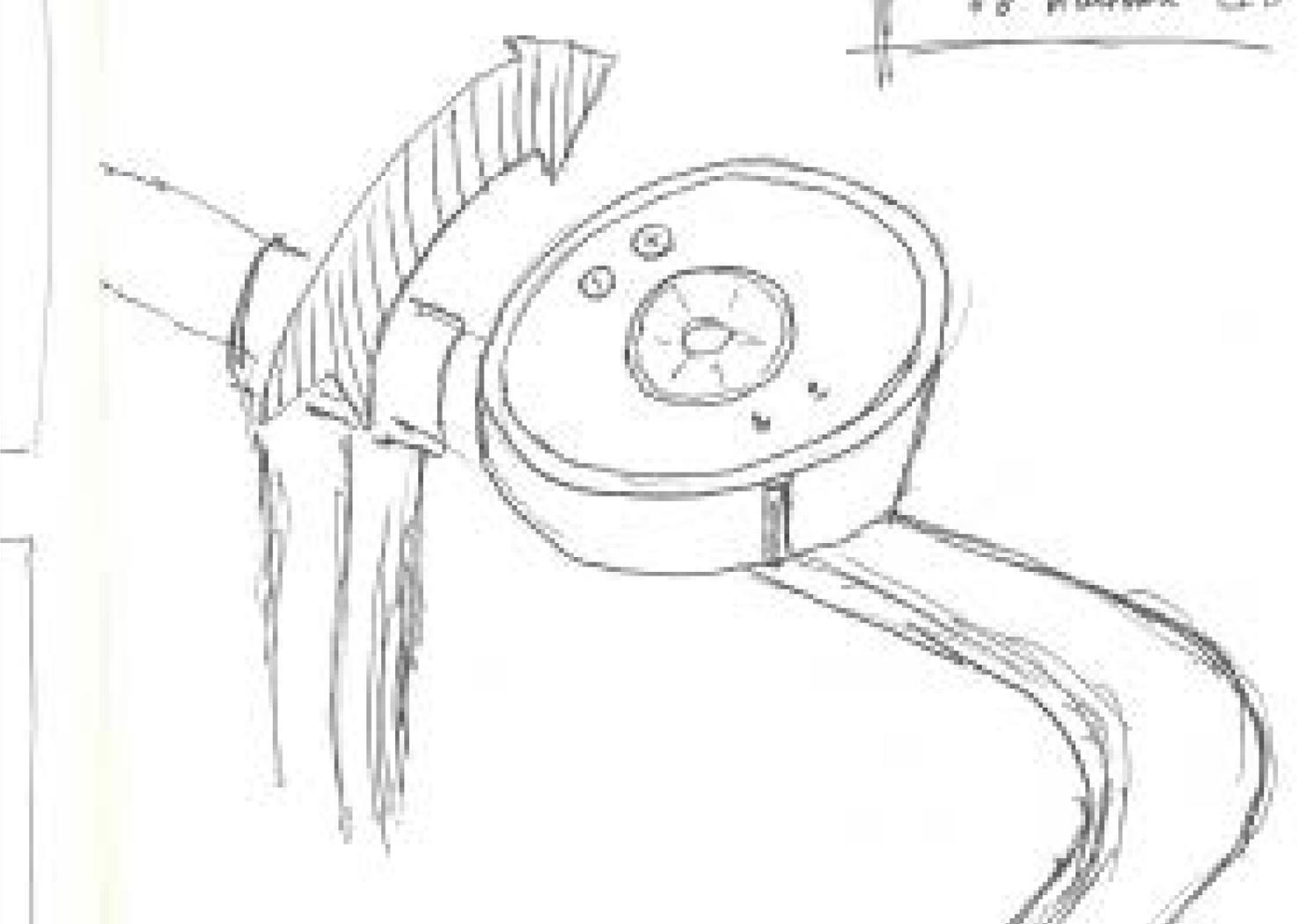
## Iteration 6:

Our final iteration is the extension of the social platform, the main function being the functionality to make custom challenges for friends. Note that this platform could easily be an app as well.

What we wanted to add here is the fun of socialising and being together with people.

We came up with this after rethinking our goals for this project. We realised we wanted to stimulate social interaction a bit more, which is how we came to this.

The result is CycleCircuit as it is now. A smart bicycle bell with social platform, that invites people to play and to discover.



# RESULTS

The design of the final prototype is a black spraypainted, wooden box. It has rounded edges and can be attached to a bike through velcro straps.

The electronics of the final prototype are a working GPS system, which is connected to a LED-ring. The GPS system can locate where the device is, and how far it is away from the coordinates (from now: destination) that are put into the code<sup>2</sup>. Depending on the distance from the destination, more lights will go on. This will show progress. Next to that, when the button is pushed at the moment it is

within a 15 meter area of the desired location, the lights will go off.

Part of our concept is a web interface to complement the CycleCircuit. Because we found out more than just one button on the device would not be a good idea, we chose to allow a change of device settings through a website or app.

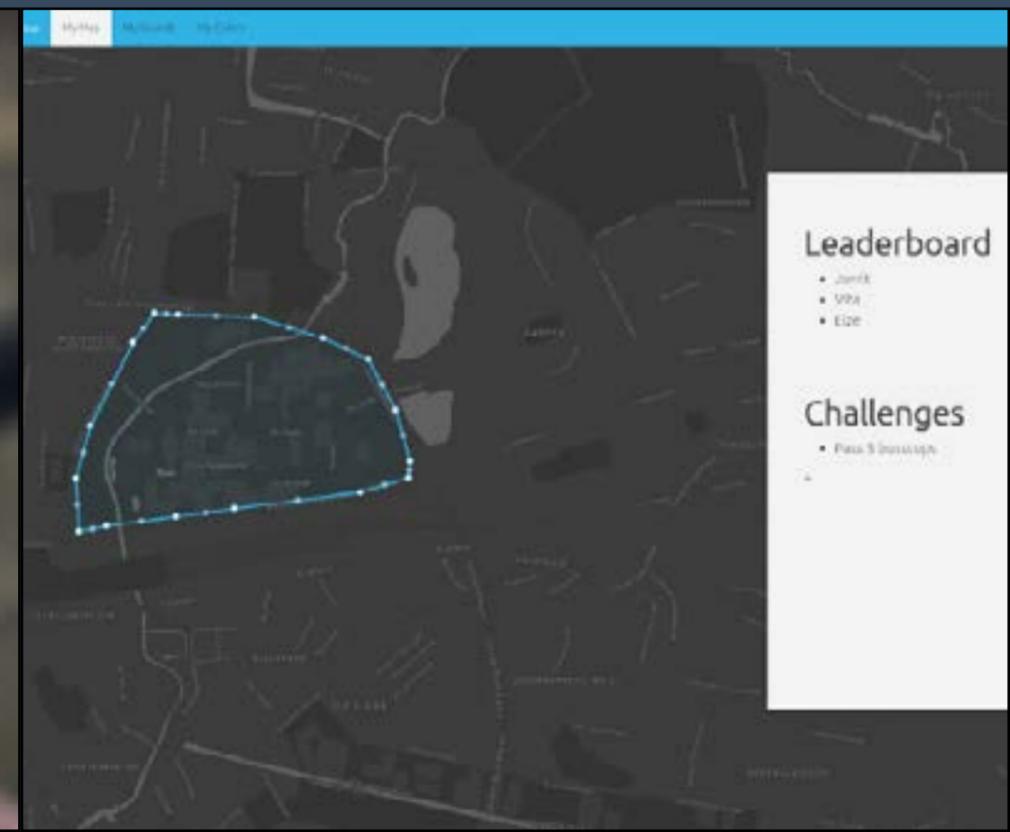
The result is a website that demonstrates this functionality. Although not all functions work how we would like them to work in the future, the core functionality is there.

The first page consists of a screen with some general information about the Cycle Circuit, a login screen and our brand name. The login function does not work yet because we could not implement a database function in time, but it simulates the actual thing.

The second screen is the screen user will use most. It consists of one big city map with overlay. This is a fully functioning Google Maps on which people can set an area in which challenges will be enabled on the device. There is also a ranking on which you can see your friends, but this is also only a mock-function because we

don't have user accounts. What works perfectly though is the list of community made challenges. You can add new challenges to a list, which you can give a location, a range and a description. Note that these won't appear on the map yet.

Third is a page on which you can set your device its sound, you listen to your sounds library and pick a sound you like. Finally there is a page to change the LED-ring color, this consists of a fully functioning colorwheel and some explanatory text. It also has the option to lock in a certain color.



# CONCLUSIONS

The goal for the concept was to create a gadget that could provide an outdoor adventure. To let children discover their neighbourhood, getting to know seeing it as entertainment and enjoying going outside again.

Both the first and the second user test showed that the concept of gaming outside can be very interesting. The children reacted very positive on the idea. They wanted to earn points, it did not matter whether it were stickers or sounds. They also enjoyed looking for the challenges without knowing, because then they had to think about what they were going to do. Furthermore, the children all wanted to beat the other kids, to become first.

“Did I win?” -Isabel

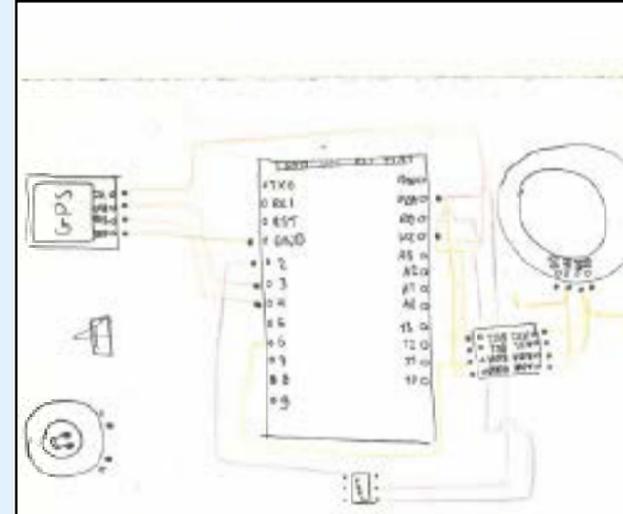
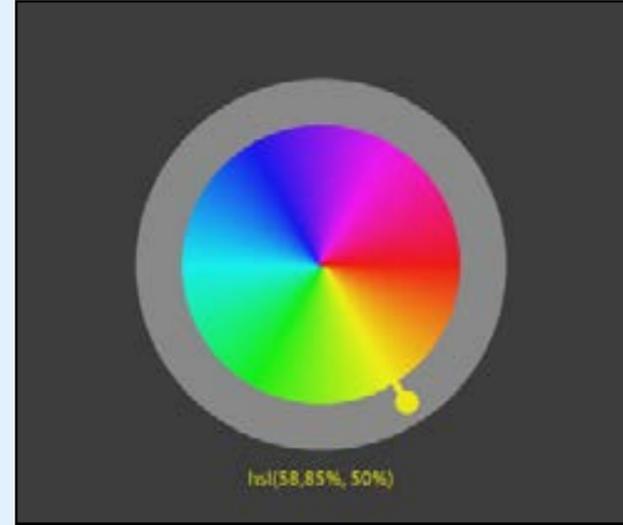
This means that the goal is realised concept wise, however the prototype was not a functioning device that could do all the actions that were intended. The final prototype had a lot of the plan B functions, this however is still in accordance with the general goal of the project

We had really high expectations about our group and teamwork. It has been too hard to reach those expectations due to personal issues. We have had troubles with miscommunication or too little communication, but sometimes we also had a lot of productive communication.

Sometimes tasks were not were not divided equally and also not all of our meeting can be considered productive. We will reflect on this in our group reflection. Our vision was very clear and we all knew what the vision of the project was. Because a lot of time is invested into this vision and concept, we all knew what we were working towards.

If we are going to develop our idea, we would optimise it and change some things. For the design, we would make different colour options. Children have positive emotions and reactions to bright colours like pink, red and blue, and negative emotions for dark colors like black, brown and grey<sup>3</sup>. So children prefer bright colours. We wanted to make the device in the standard colours pink, blue, green and red. When optimizing the technical part, we want to find out how we could make the electronics as small as possible. This way, the case could be a little smaller as well. We wanted to make the intersection of the whole device around 80 mm, which more resembles the format of a big bicycle bell.

We also want to make it easier to connect the device to the bicycle steering wheel. There are more possibilities for this when our device is smaller. We wanted to use stretchy rubber strips, these are already often used to connect bicycle lights on your steer. The device will



be used outside, so we need to make the case waterproof. We are thinking of using the material acrylate, this material is suitable for outside, it is available in lots of colours and appropriate to adapt<sup>4</sup>. We want to make the push button, which is used for ringing the bell, some bigger and easier to press. We want to make this from silicone or rubber, because this is soft, malleable material.

We also want to develop the features of the device. To make another social aspect, we thought about the possibility to connect your device with friends. This could be achieved with NFC. Children only have to hold their devices to each other to connect. When connected, the child has access to his friend's area. By holding the devices to each other, you disconnect again and you return to your own game in your own area.

For connecting with the platform, we need to make the USB-input working. On the platform, children will be able to see points on the map where the challenges will be located. They have an idea for where to find the challenge. This will be an educative element as well, it can be used to learn how to read maps. The children are also able to see which challenges they have done. These points will turn into another color.

# REFLECTIONS

## Vita Broeken

In my Personal Development Plan I stated a few personal goals for our project. In this project I wanted to learn about user research and engagement; how I could best approach possible users of our concept, how to setup a user test and what to do with the results. Another important goal to me was how to work with electronics; how to solder, what components to use and how to write an Arduino program. I will reflect on these goals and on an unexpected thing I have learned a lot about; teamwork.

I have two goals about the users, so I suggested to take care of organising, preparing and going to the user tests. I started approaching several elementary schools and after school care facilities. After being turned down several times, I looked a bit into what the different institutions stood for and found an after school care that was mainly focussed on getting children to play outside. They were enthusiastic from the start and loved to help us out. From this I have learned that in the future it might be useful to look into the vision of a group or organisation, to see if it is similar to the vision of the project. Because this will increase the chances of them agreeing to help.

Together with Elzelinde we took care of the first user test. During this test we did not know the surrounding we would be in, which made it slightly more difficult to prepare well. However, we came up with some general concepts we could test, which we used during the test and we could immediately see the result of those concepts. What I learned from that user test is that preparation is key, without the preparation we probably would not have learned anything from the test. The second user test I did together with Tyana. This time it was completely different, we got a lot more children and even more space. So we had to come up with some sort of game, because we only had one bike to test our ideas with. Eventually, through this game, we found out that competition is very encouraging to the young children. From this user test I learned that some changes can help the user test, and that together with the possible users, you can get the best out of such a test.

Halfway through the second quartile we decided to switch up the tasks, up to that point Elzelinde and I had been working on the concept, the prototype and the user tests. While Jorrit had been working on the GPS, because both of us were not progressing that much anymore, we changed off

the tasks and we got to work on the electronics. I was really glad with this change, because now I could work on my goal to learn more about electronics. Because I knew basically nothing, I just started googling and trying until I understood what was happening. Together with the support in the e-lab, without them we would completely have failed, and Peter Peters I learned how to read and write a code, how to work with a GPS system, how to use neopixels and a button. Also, I learned about how to solder, and mainly how not to solder and lastly, how to connect wires to the arduino. In the future I will be able to use the knowledge I have gained and implement it into other technologies.

Next to the things I wanted to learn during this project I also discovered and learned things I did not expect to in the beginning. At the start of our project we spent an extreme amount of time brainstorming. When we had the meeting workshop, we tried to implement this and tried making more progress. A major thing I have learned from this is that you can better start working on an idea, and maybe somewhere along the way you can look back and change something about the concept. But a concept does not have to be perfect when you start trying out and testing.

Another big lesson to me was teamwork. Due to personal issues of one of the group members, we had to deal with a change in group formation. We had to reschedule what had to be done and by whom. We learned how to talk and discuss difficulties within a group, so that we would maintain the good group atmosphere we started with. We faced difficulties in the communication, which resulted in some tension and delay. However, I think we did fairly well, and worked out the teamwork problems well enough to continue progressing. The main thing I have learned from this, is that, as a group, you can not foresee unintended difficulty. In such a situation, communication is very important to maintain a good atmosphere and working spirit. In the future I hope to use this, and make sure that communication will be key.

In conclusion, I have gained knowledge about user interaction through user tests. I have learned how to work with electronics because of the change of tasks. I figured out that trying and evaluating is better than perfecting and then finishing. Lastly, I realised that teamwork itself takes a lot of effort and in the future I hope I can implement all these lessons.

## Elzelinde van Doleweerd

Before I started working on this project, I already made some personal project goals. I wrote them down in my Personal Development Plan. One of my learning goals for this project was to gain more knowledge and insights in making use of electronics. Another goal was to implement my gained knowledge of the elective 'Basic Formgiving Skills' in this project. Furthermore I wanted to make use of the machines in Vertigo, I have always been a bit afraid of using them. The last goal was to have efficient meetings and to have a positive vibe in the group. I will refer to these goals in the rest of the reflection.

Starting the project, we spent a lot of time to come up with the right idea. When looking back on this phase, we wasted some time there in my opinion. I learned from this for the next time, that you sometimes just have to choose a direction and to stand by your view. It is good to take a step back sometimes, but you also have to go further to continue developing your idea. When we finally chose one idea, and developed this together, everyone was enthusiastic about it. Besides that, we got along with each other very well, so my goal for the positive vibe was not a problem. The meetings were not always very efficient. To change this we tried different things. We made a better planning, so we knew which things had to be done and when, and we planned dates to work together on the project. This made the meetings already more efficient.

Due to personal issues of one of the group members, we had to deal with unattend-

ed consequences. We had some problems with the communication and we had to make a new division of the tasks. We had some delays and problems with continuing the process. You can not foresee such difficulties. If such a situation would occur again in my future projects, I learned that it is important that you even have to try to work more efficiently, when trying to do the workload of four people by three people. Furthermore I learned that it is needed to keep the positive vibe in the group, to stay enthusiastic and to have a good communication, this way you are able to continue.

Jorrit worked on the GPS system, I worked with Vita on the concept, the design and the user tests. When doing the user tests, we got a lot of development ideas when observing and interviewing the children. I learned that when you really are with the user, you expand your perception and you get different insights. For the design, I worked together with Vita in Vertigo, she taught me how the machine worked, which was one of my goals. This was actually quite easy. I know now that I can save lots of time when using the machines.

We changed tasks to make the development even more efficient, and to reach our personal goals. Vita and I finally succeeded in developing the GPS system. After this, we started with programming and connecting the electronics. Gradually, Vita worked more on the programming part and I worked more on connecting the electronics. I developed my knowledge in elec-



tronics, I learned how you can make use of the internet for this, how you can test electronics, I learned to solder and to use the GPS system.

To make use of my gained knowledge from the 'Basic Formgiving skills' elective, I did the finishing part of the prototype, I spray painted it. This went well, I was satisfied about the smooth, glossy result and I got a lot of nice feedback from other people. Unfortunately we could not use the GPS system during the presentation, because it did not work inside the building. We decided to show the device with the light feedback, so we were able to explain the working system. Sometimes I find it difficult to present, I was a bit nervous beforehand. But I had prepared it well, our presentation looked nice and actually I like to show our idea to students and teachers. I enjoyed presenting it and I was satisfied about our result.

To conclude, I reached my goals. Some more extensive or easier than others. For efficient groups work, I learned that it is useful to make deadlines for the group beforehand. This way you will work more efficient. Furthermore it can be efficient to change tasks during your process. I already know much more about electronics and how to use them on the right way. From the user-tests I learned the need to really be with the user when developing your idea. Also I dare to use the machines in Vertigo now and I know now that when I am enthusiast about my own project, it is easier to present it to others.

## Jorrit van der Heide

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## Tyana Hendriksma

Before the start of this course I was very excited to work on my first actual project. Since we have mainly done bachelor college courses it was nice to finally put everything into practice.

Unfortunately near the end of quartile 2 I started to experience physical complaints aswell as some personal issues. This is why I did not take any electives in the past quartile, but I did not want to give up on the project. After I got most of my physical health taking care of I started therapy for my eating disorder and depression. Which has unfortunately taken up the majority of my time this past semester.

I could not attend all the meetings but I tried my best to stay up to date and helped out where I could. It was really frustrating for me that I was not able to do as much as I wanted, but I tried to find a balance between being as useful as I could possibly be for my group and developing the personal goals I had for this project.

That is why I was eager to help Jorrit out with soldering and electronics and Vita with usertesting. Although in the end, it became clear to me that I had to set my personal goals for this project aside and focus on the things that I could do for the project, for example edit the videos or take pictures. Because of my previous experience with video- and photography these type of things were manageable for me to do.

Communication is an important part of each project and the last semester was a huge learning experience for me on this aspect. It was fairly difficult for me to be more open about my situation but I realized quickly that I had to think about what was best for the group and good communication was definitely needed.

A challenge for me was also the fact that I had to take much more of an assisting roll in this project.



# APPENDICES

## Video's

Video Midcrit: <https://vimeo.com/169981439>  
password: cyclecircuit

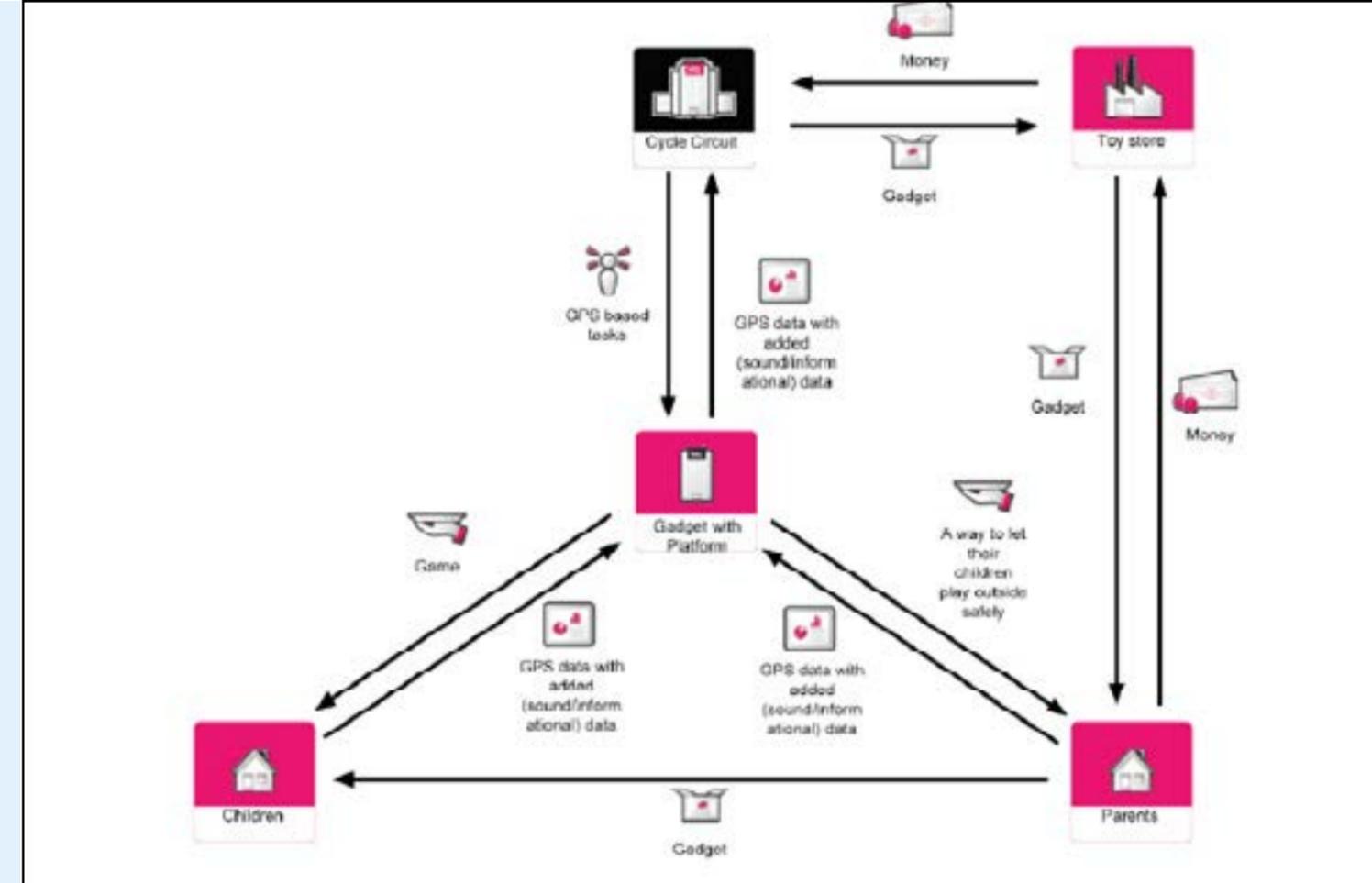
Video DemoDay: <https://vimeo.com/169983216>  
password: cyclecircuit2

Screenvideo to show data GPS: <https://vimeo.com/169989544>  
password: datagps

## Business Plan

The gadget with the platform is the main connector in the business model. The company Cycle Circuit and the children are connected through the gadget. Also the parents and the company are connected through this gadget, however here also the toy store plays a big role.

Money transactions take place between the company and the toy store and between the toy store and the parents. Data transaction (for example personal information and GPS data) are between the children, the parents and the gadget and the gadget and the company<sup>5</sup>.

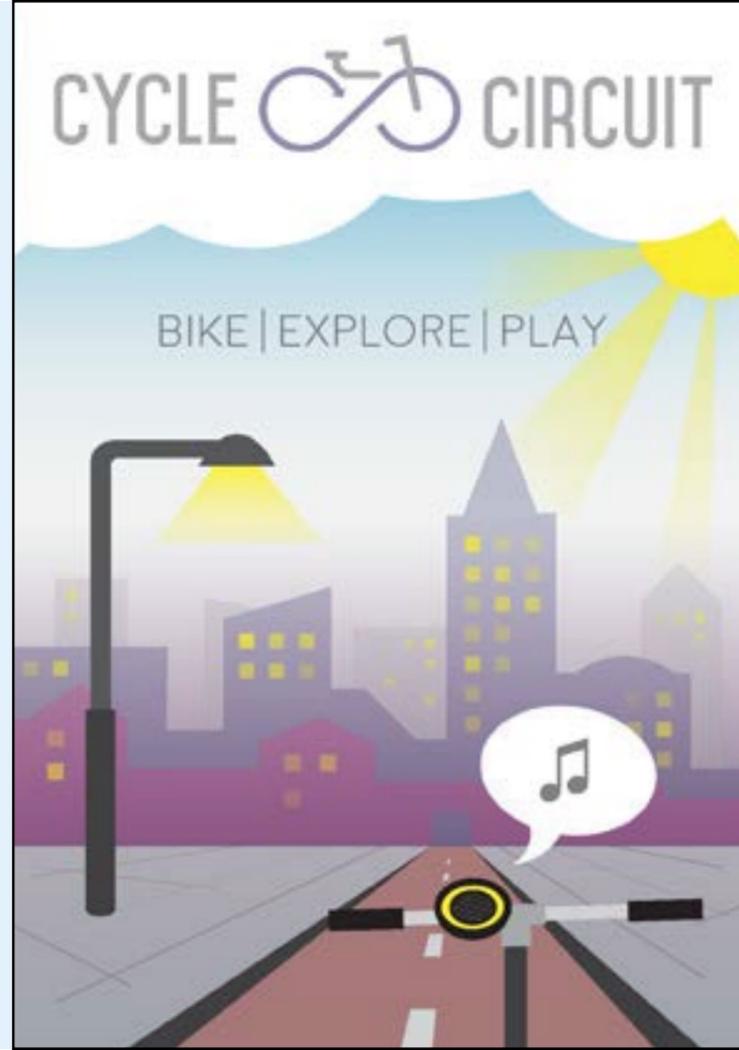


## Posters

Midcrit & Demo day Posters.

## Concent Forms

Consent forms to ask permission for the user tests.



B1 / Design Project  
Sports

## CYCLE CIRCUIT

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We also stimulate social interaction by means of an online platform, which gives the opportunity to make your own challenges and share them with the community.

**Coach:** Tijmen Kervers  
**Students:** Elzelinde van Doleweerd, Vita Broeken, Tyana Hendriksma & Jorrit van der Heide

TU/e Technische Universiteit Eindhoven University of Technology

Name: Jorrit, Tyana, Elzelinde Vita  
Titel: Cycle Circuit  
Tel: 0655619902  
email: v.broeken@student.tue.nl

Technische Universiteit Eindhoven, 24 Mei 2016

### Toestemmings Formulier

Voor het eerstejaars sport project van de studie Industrial Design aan de Technische Universiteit Eindhoven doen wij een gebruikerstest met kinderen. Wij zijn bezig met het ontwikkelen van 'Cycle Circuit', een gadget om kinderen op spelender wijze te motiveren meer te gaan fietsen. Door deze test te filmen hebben wij de mogelijkheden de kinderen daarbij te analyseren, zo kunnen wij onze ideeën verbeteren en een eventueel promotiefilmpje maken.

Uw kind is uitgenodigd om deel te nemen aan een onderdeel van dit project waarin onderzoek wordt gedaan naar de beleving en ervaring bij het gebruiken van ons product. Onderdeel hiervan is het fietsen in de omgeving waarbij opdrachten worden uitgevoerd. Vervolgens worden hierover vragen gesteld aan uw kind over zijn/haar beleving.

Indien u niet akkoord gaat met de doelname van uw kind aan de gebruikerstest, kunt u dit bij ons aangeven. Alle informatie zal als vertrouwelijk worden behandeld tenzij u aan geeft dat het publiekelijk mag worden gemaakt.

- Ik geef **wel** toestemming, mijn video's en foto's openbaar te publiceren op internet en sociale media daarnaast mag mijn data worden gebruikt ten behoeven van het onderzoek. Mijn data zal anoniem worden verwerkt.
- Ik geef **geen** toestemming, mijn video's en foto's openbaar te publiceren op internet of andere media mijn data mag uitsluitend anoniem worden verwerkt ten behoeven van het onderzoek. Ik zal niet in enige video te zien of te horen zijn.

Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan dit interview. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadigt ingeval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: 01-06-2016

Naam participant: Isidias

Handtekening participant: [Handwritten Signature]

Datum: 01-06-2016

Naam student: Vita Broeken

Handtekening student: [Handwritten Signature]

TU/e Technische Universiteit Eindhoven University of Technology

Name: Jorrit, Tyana, Elzelinde Vita  
Titel: Cycle Circuit  
Tel: 0655619902  
email: v.broeken@student.tue.nl

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- Ik geef **geen** toestemming, mijn video's en foto's openbaar te publiceren op internet of andere media mijn data mag uitsluitend anoniem worden verwerkt ten behoeven van het onderzoek. Ik zal niet in enige video te zien of te horen zijn.

Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan dit interview. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadigt ingeval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: 1-06-2016

Naam participant: Marinus Puyjabon

Handtekening participant: [Handwritten Signature]

Datum: 1-06-2016

Naam student: Vita Broeken

Handtekening student: [Handwritten Signature]



B1 / Design Project  
Sports

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We also stimulate social interaction by means of an online platform, which gives the opportunity to make your own challenges and share them with the community.

**Coach:** Tijmen Kervers  
**Students:** Elzelinde van Doleweerd, Vita Broeken, Tyana Hendriksma & Jorrit van der Heide



```

print_float(flat, TinyGPS::GPS_INVALID_F_ANGLE, 10, 6);
print_float(flon, TinyGPS::GPS_INVALID_F_ANGLE, 11, 6);
print_int(age, TinyGPS::GPS_INVALID_AGE, 5);
print_date(gps);
print_float(gps.f_altitude(), TinyGPS::GPS_INVALID_F_ALTITUDE, 7, 2);
print_float(gps.f_course(), TinyGPS::GPS_INVALID_F_ANGLE, 7, 2);
print_float(gps.f_speed_kmph(), TinyGPS::GPS_INVALID_F_SPEED, 6, 2);
print_str(gps.f_course() == TinyGPS::GPS_INVALID_F_ANGLE ? "*** " :
TinyGPS::cardinal(gps.f_course()), 6);
print_int(flat == TinyGPS::GPS_INVALID_F_ANGLE ? 0xFFFFFFFF : (unsigned
long)TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON), 0xFFFFFFFF,
9);
print_float(flat == TinyGPS::GPS_INVALID_F_ANGLE ? TinyGPS::GPS_INVALID_F_ANGLE :
TinyGPS::course_to(flat, flon, LAPLACE_LAT, LAPLACE_LON), TinyGPS::GPS_INVALID_F_
ANGLE, 7, 2);
print_str(flat == TinyGPS::GPS_INVALID_F_ANGLE ? "*** " : TinyGPS::car-
dinal(TinyGPS::course_to(flat, flon,
LAPLACE_LAT, LAPLACE_LON)), 6);
gps.stats(&chars, &sentences, &failed);
print_int(chars, 0xFFFFFFFF, 6);
print_int(sentences, 0xFFFFFFFF, 10);
print_int(failed, 0xFFFFFFFF, 9);
Serial.println();

smartdelay(1000);
buttonState = digitalRead(buttonPin);
/**sets the lights when we are very close*/

if (TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) <= 15)
{
pixels.begin();

pixels.setPixelColor(12, pixels.Color(200, 0, 200));
pixels.setPixelColor(11, pixels.Color(200, 0, 200));
pixels.setPixelColor(10, pixels.Color(200, 0, 200));
pixels.setPixelColor(9, pixels.Color(200, 0, 200));
pixels.setPixelColor(8, pixels.Color(200, 0, 200));
pixels.setPixelColor(7, pixels.Color(200, 0, 200));
pixels.setPixelColor(6, pixels.Color(200, 0, 200));
pixels.setPixelColor(5, pixels.Color(200, 0, 200));
pixels.setPixelColor(4, pixels.Color(200, 0, 200));
pixels.setPixelColor(3, pixels.Color(200, 0, 200));
pixels.setPixelColor(2, pixels.Color(200, 0, 200));
pixels.setPixelColor(1, pixels.Color(200, 0, 200));

pixels.show();
while (buttonState == HIGH) {
pixels.begin();

pixels.setPixelColor(12, pixels.Color(0, 0, 0));
pixels.setPixelColor(11, pixels.Color(0, 0, 0));
pixels.setPixelColor(10, pixels.Color(0, 0, 0));

```

```

pixels.setPixelColor(9, pixels.Color(0, 0, 0));
pixels.setPixelColor(8, pixels.Color(0, 0, 0));
pixels.setPixelColor(7, pixels.Color(0, 0, 0));
pixels.setPixelColor(6, pixels.Color(0, 0, 0));
pixels.setPixelColor(5, pixels.Color(0, 0, 0));
pixels.setPixelColor(4, pixels.Color(0, 0, 0));
pixels.setPixelColor(3, pixels.Color(0, 0, 0));
pixels.setPixelColor(2, pixels.Color(0, 0, 0));
pixels.setPixelColor(1, pixels.Color(0, 0, 0));

pixels.show();
buttonState = digitalRead(buttonPin);
}
}
else if ((TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) > 15)
&&
(TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) <= 20))
{
pixels.begin();
pixels.setPixelColor(12, pixels.Color(0, 200, 0));
pixels.setPixelColor(11, pixels.Color(0, 200, 0));
pixels.setPixelColor(10, pixels.Color(200, 200, 200));
pixels.setPixelColor(9, pixels.Color(200, 200, 200));
pixels.setPixelColor(8, pixels.Color(200, 200, 200));
pixels.setPixelColor(7, pixels.Color(200, 200, 200));
pixels.setPixelColor(6, pixels.Color(200, 200, 200));
pixels.setPixelColor(5, pixels.Color(200, 200, 200));
pixels.setPixelColor(4, pixels.Color(200, 200, 200));
pixels.setPixelColor(3, pixels.Color(200, 200, 200));
pixels.setPixelColor(2, pixels.Color(200, 200, 200));
pixels.setPixelColor(1, pixels.Color(200, 200, 200));

pixels.show();
}
else if ((TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) > 20)
&&
(TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) <= 25))
{
pixels.begin();

pixels.setPixelColor(12, pixels.Color(0, 0, 0));
pixels.setPixelColor(11, pixels.Color(0, 0, 0));
pixels.setPixelColor(10, pixels.Color(0, 0, 0));
pixels.setPixelColor(9, pixels.Color(200, 200, 200));
pixels.setPixelColor(8, pixels.Color(200, 200, 200));
pixels.setPixelColor(7, pixels.Color(200, 200, 200));
pixels.setPixelColor(6, pixels.Color(200, 200, 200));
pixels.setPixelColor(5, pixels.Color(200, 200, 200));
pixels.setPixelColor(4, pixels.Color(200, 200, 200));
pixels.setPixelColor(3, pixels.Color(200, 200, 200));

```



```

pixels.setPixelColor(5, pixels.Color(0, 0, 0));
pixels.setPixelColor(4, pixels.Color(200, 200, 200));
pixels.setPixelColor(3, pixels.Color(200, 200, 200));
pixels.setPixelColor(2, pixels.Color(200, 200, 200));
pixels.setPixelColor(1, pixels.Color(200, 200, 200));

pixels.show();
}
else if ((TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) > 75)
&amp;&amp;
(TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) <= 85))
{
pixels.begin();

pixels.setPixelColor(12, pixels.Color(0, 0, 0));
pixels.setPixelColor(11, pixels.Color(0, 0, 0));
pixels.setPixelColor(10, pixels.Color(0, 0, 0));
pixels.setPixelColor(9, pixels.Color(0, 0, 0));
pixels.setPixelColor(8, pixels.Color(0, 0, 0));
pixels.setPixelColor(7, pixels.Color(0, 0, 0));
pixels.setPixelColor(6, pixels.Color(0, 0, 0));
pixels.setPixelColor(5, pixels.Color(0, 0, 0));
pixels.setPixelColor(4, pixels.Color(0, 0, 0));
pixels.setPixelColor(3, pixels.Color(200, 200, 200));
pixels.setPixelColor(2, pixels.Color(200, 200, 200));
pixels.setPixelColor(1, pixels.Color(200, 200, 200));
pixels.show();
}
else if ((TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) > 85)
&amp;&amp;
(TinyGPS::distance_between(flat, flon, LAPLACE_LAT, LAPLACE_LON) <= 95))
{
pixels.begin();

pixels.setPixelColor(12, pixels.Color(0, 0, 0));
pixels.setPixelColor(11, pixels.Color(0, 0, 0));
pixels.setPixelColor(10, pixels.Color(0, 0, 0));
pixels.setPixelColor(9, pixels.Color(0, 0, 0));
pixels.setPixelColor(8, pixels.Color(0, 0, 0));
pixels.setPixelColor(7, pixels.Color(0, 0, 0));
pixels.setPixelColor(6, pixels.Color(0, 0, 0));
pixels.setPixelColor(5, pixels.Color(0, 0, 0));
pixels.setPixelColor(4, pixels.Color(0, 0, 0));
pixels.setPixelColor(3, pixels.Color(0, 0, 0));
pixels.setPixelColor(2, pixels.Color(0, 200, 200));
pixels.setPixelColor(1, pixels.Color(0, 200, 200));

pixels.show();
}

```

```

else {
pixels.begin();
pixels.setPixelColor(12, pixels.Color(0, 0, 0));
pixels.setPixelColor(11, pixels.Color(0, 0, 0));
pixels.setPixelColor(10, pixels.Color(0, 0, 0));
pixels.setPixelColor(9, pixels.Color(0, 0, 0));
pixels.setPixelColor(8, pixels.Color(0, 0, 0));
pixels.setPixelColor(7, pixels.Color(0, 0, 0));
pixels.setPixelColor(6, pixels.Color(0, 0, 0));
pixels.setPixelColor(5, pixels.Color(0, 0, 0));
pixels.setPixelColor(4, pixels.Color(0, 0, 0));
pixels.setPixelColor(3, pixels.Color(0, 0, 0));
pixels.setPixelColor(2, pixels.Color(0, 0, 0));
pixels.setPixelColor(1, pixels.Color(100, 0, 0));

pixels.show();

}
}
static void smartdelay(unsigned long ms)
{
unsigned long start = millis();
do
{
while (ss.available())
gps.encode(ss.read());
} while (millis() - start < ms);
}
static void print_float(float val, float invalid, int len, int prec)
{
if (val == invalid)
{
while (len-- > 1)
Serial.print(&#39;*#39;);
Serial.print(&#39; &#39;);
}
else
{
Serial.print(val, prec);
int vi = abs((int)val);
int flen = prec + (val < 0.0 ? 2 : 1); // . and -
flen += vi >= 1000 ? 4 : vi >= 100 ? 3 : vi >= 10 ? 2 : 1;
for (int i=flen; i<len; ++i)
Serial.print(&#39; &#39;);
}
smartdelay(0);
}
static void print_int(unsigned long val, unsigned long invalid, int len)
{
char sz[32];

```

```

if (val == invalid)
strcpy(sz, &quot;*****&quot;);
else
sprintf(sz, &quot;%ld&quot;, val);
sz[len] = 0;
for (int i=strlen(sz); i<len; ++i)
sz[i] = &#39; &#39;;
if (len &gt; 0)
sz[len-1] = &#39; &#39;;
Serial.print(sz);
smartdelay(0);
}
static void print_date(TinyGPS &amp;gps)
{
int year;
byte month, day, hour, minute, second, hundredths;
unsigned long age;
gps.crack_datetime(&amp;year, &amp;month, &amp;day, &amp;hour, &amp;minute, &am-
p;second, &amp;hundredths, &amp;age);
if (age == TinyGPS::GPS_INVALID_AGE)
Serial.print(&quot;***** ***** &quot;);
else
{
char sz[32];
sprintf(sz, &quot;%02d/%02d/%02d %02d:%02d:%02d &quot;,
month, day, year, hour, minute, second);
Serial.print(sz);
}
print_int(age, TinyGPS::GPS_INVALID_AGE, 5);
smartdelay(0);
}
static void print_str(const char *str, int len)
{
int slen = strlen(str);
for (int i=0; i<len; ++i)
Serial.print(i<slen ? str[i] : &#39; &#39;);
smartdelay(0);
}

```

## References

1. Wright, C. (2006, August 22). Health Reports. 17(2005003), 37-38. Retrieved from <http://www.statcan.ca/english/rdc/index.htm>
2. Appendices
3. Boyatzis, C. J., & Varghese, R. (1994). Children's Emotional Associations with Colors. *The Journal of Genetic Psychology*, 155(1), 77-85. doi:10.1080/00221325.1994.9914760.
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5. De Ridder, P., & De Mey, N. (n.d.). Board of innovation - Business model. Retrieved March 1, 2016, from <http://www.boardofinnovation.com/>.

