Cloudia

IAN BEZEMER | ALEXANDRA VAN DIJK | ANNA VAN DIJK | NIELS HORREVOETS
1413236 1440608 1581902 1564323

COACHES: REGINA BERNHAUPT, GÜNTHER WALLNER

WORD COUNT: 5979

13 / 01 / 2022

ABOUT THE PROJECT

> “THE GOAL IS TO HELP PEOPLE ON THE WORK FLOOR COMMUNICATE MORE ABOUT THEIR FEELINGS.”

FIGURE 1: OFFICE WORKERS DISCUSSING THEIR EMOTIONS

Psychological distress is a common mental health problem in the working space (Henderson et al., 2011). When left untreated this mental health problem could result in long-term sickness and absence (Corné A. M. Roelen, 2013). Therefore, it is important to look into this problem. For this project, this subject will be approached by coming up with a concept and looking at different design aspects which influence talking about emotions on the work floor. The concept which this paper will use to do this is called Cloudia. This concept will be adjusted along the design process so that the design goal can be fulfilled as good as possible. The goal of the design is to change behaviour playfully by collecting data and coming up with a concept that will help people on the work floor communicate more about their feelings. This will hopefully lead to a better workflow and less psychological distress in the office.

During the project, we tried to follow the reflective transformative design process. This process guided us throughout the whole project. The global steps we took are displayed in the visual (Figure 2). These steps will be explained in the rest of the report.

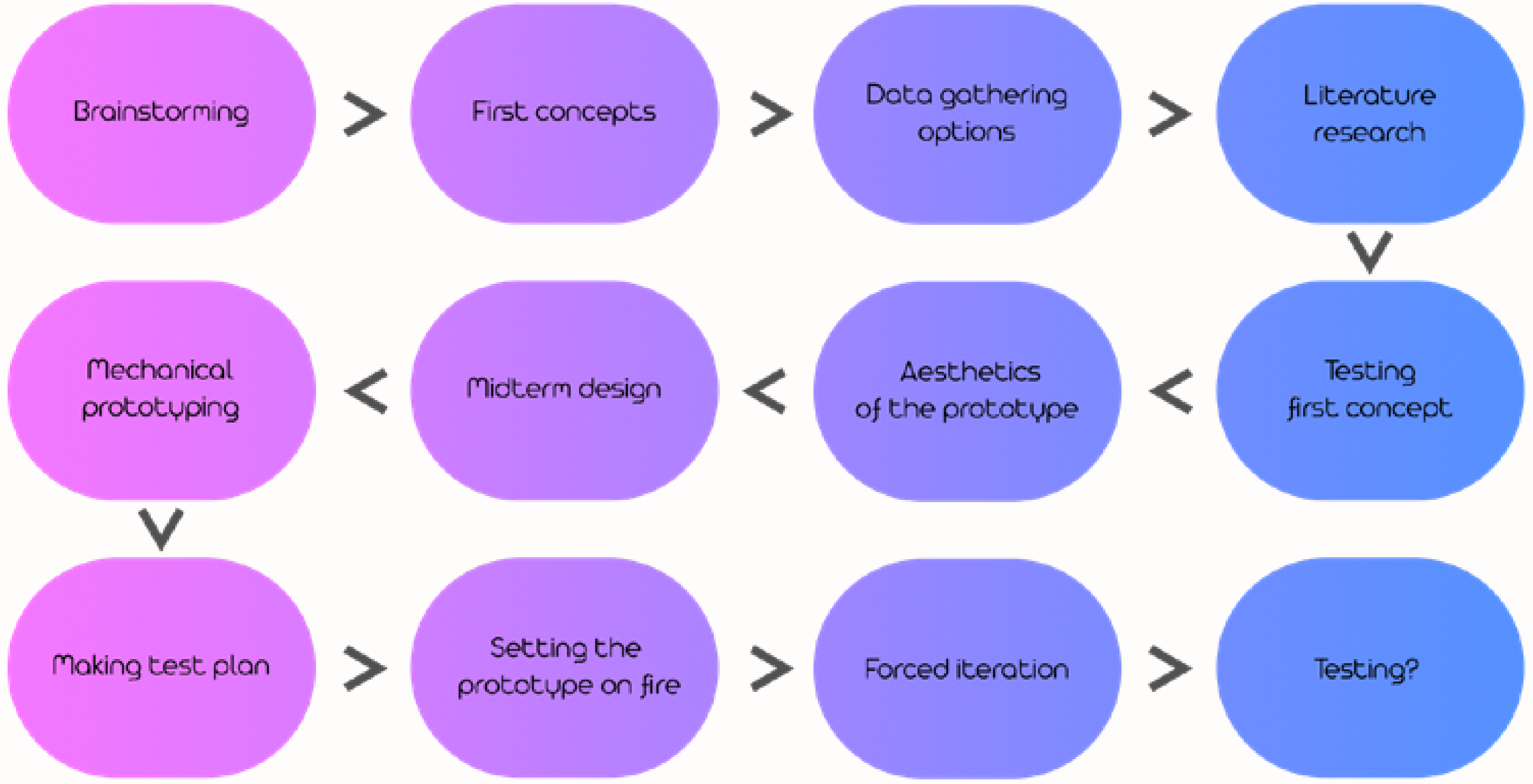


FIGURE 2: DIAGRAM OF PROCESS

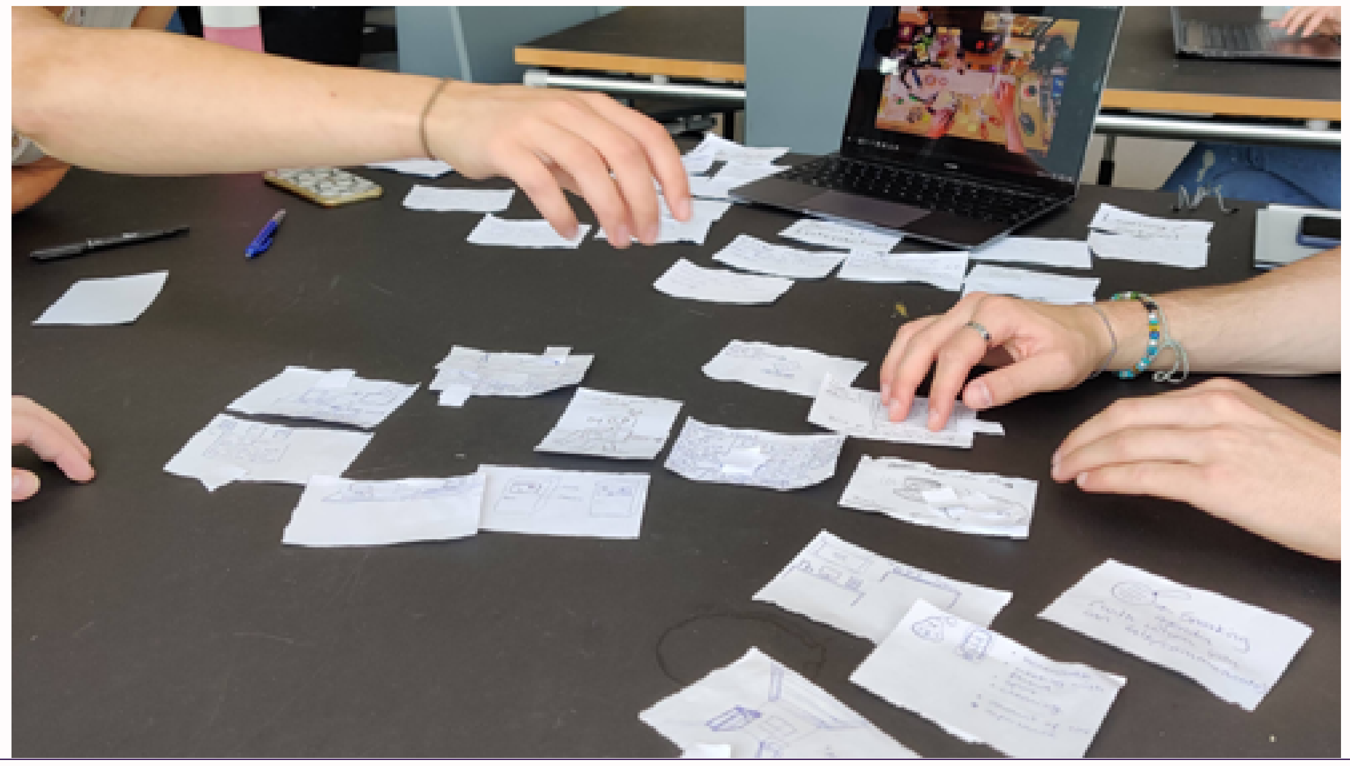
PROCESS

BRAINSTORM & FIRST ITERATIONS

Aside from the project's theme of 'Data Communication', there was no specific topic that was to be adhered to. As a result, the very first phase of the project revolved around making a decision on the theme that would be explored. This was done using a variety of brainstorming methods, most notably the 'How might we...' method (Odell Keller, 2019). This method consists of coming up with questions on how to achieve a certain goal, by asking questions starting with 'How might we...?'. This then gives a list of problems that the design team can try finding a solution for.

Using this method resulted in a fair number of problem statements that could be looked into further. The questions were sorted into an affinity diagram, giving an overview of the themes that came up repeatedly. Some notable ones were: Lifestyle, Social Interaction, Learning and School, Work Environment, and World Problems. In the following step, some of the problems were broadly explored by giving each team member the freedom to ideate on possible solutions to the problem. Each member of the project team was given 5 minutes per problem and numerous post-its to come up with as many ideas as they could, no matter how feasible or out-of-the-box.

FIGURE 3: PHOTO OF IMAGE-INATION BRAIN-STORM SESSION



From the 5 recurring topics, the one with the most potential was then voted for and selected; the Work Environment theme was decided to be explored. Using another method – "Image(-ination)" brainstorming (Teplizza, n.d.) – an additional round of brainstorming was held. This time, by viewing a photo of an office space, we tried to immerse ourselves in the environment for which we would design, in order to come up with potential problems and/or solutions for that space (Figure 3). At the end of the session, we were left with a large number of designs that could then be iterated upon further.

Some feedback that we received in Week 1 of the project was to quickly start narrowing down our design space, deciding on a theme and direction we would go in. We were also advised to think about playfulness in our design, and to simply start by doing something – making prototypes instead of merely devising ideas.

FIGURE 5: DRAWING OF GROWING TREE CONCEPT

This culminated into a concept we were comfortable with exploring further. The idea was to use an ambient display showing the collective emotional state of office workers in a given room, and researching what kind of effect this could have on the workers' wellbeing. Possible designs for this ambient display were also discussed; the initial idea was that of a large cloud-shaped object suspended from the office ceiling. The changing colours of the cloud would be indicative of the various emotions present inside the room. (Figure 4)

Another take on the concept was a tree with branches spreading across the office space (Figure 5). This would introduce a more natural feel to the design and allow for some playful interactions; office workers could input their emotional state through the use of watering cans, for example, and the emotions would be displayed by fruit hanging from the branches. Workers could 'pluck' fruit from the branches to showcase their emotional state to co-workers on a more personal level. This would be very personal which could lead to not wanting to pick the fruit. In this way the design would maybe not be used that much. We therefore opted for the cloud design instead, since we thought it would be more private, with a lower threshold, less intrusive and more pleasing to look at.

FIGURE 4: DRAWING OF COLOURED CLOUDS CONCEPT

DATA GATHERING

The next step was to figure out a way of collecting the data on the workers' mental wellbeing. In the first iteration of the concept, this was done by introducing coloured buttons placed at the entrance of an office space (Figure 6). This was chosen so that the bar, to fill the emotions in, would be set as low as possible since the user needs to go through the door anyway. The various colours indicated various emotions, and a button would need to be pressed to open the door. However, this idea was discarded due to being rather intrusive, and the gathered data would run the risk of being unreliable since office workers might simply press a random button to get inside the office. The emotions gathered were also categorical. This would mean that if a user would be feeling 51% stressed and 49% sad, the stressed button would be pressed which gives a bad representation of the true feelings of the user.

The logical way of going about the data gathering was to design an object, easy to interact with, that would be optional to use but inviting enough that a majority of the office workers would be willing to input their emotional data. Our goal, then, was to make the data gathering a fun and playful, yet short experience that would not interfere with the workers' daily schedule.

LITERATURE FINDINGS

Before continuing with designing and testing the concept, we conducted research. By doing this research we tried to confirm that we were heading in the right direction. The scientific article of Gopinath, R. (2009) describes the effects of conflicts on negative emotions in the workspace. For example when an employee distances themselves from the conflict so the negative emotions do not have to linger around any longer which has a positive effect on their performance. Specifically, the passive negative emotions were found to negatively affect both in-role and extra-role performance the following day' 'active negative emotions are short-lived and serve a quick recovery from a conflict event.' The article states that passive negative emotions like sadness and guilt have a negative effect on the productivity of the employee. So this confirms that negative emotions have a negative effect on the workspace and can be resolved quite easily, by talking about them or preventing confrontations.

The scientific paper of Bernhaupt, R., Boldt, A., Mirlacher, T., Wilfinger, D., & Tscheligi, M. (2007) is on testing emotions as an input for games. This article has some nice giveaways we can use further on. Emotional flowers (how the game is called) 'has demonstrated that emotions influence people's attitude towards their current and next action and there is evidence that they play an essential role in rational decision making, perception, learning, and other cognitive functions.' In the paper, they describe that they tested the game in a real-life setting. This showed that the game became boring after 2 to 3 days. So this was something we had to keep in mind while designing. Besides that, it also showed that it was hard to be honest about negative emotions.

FIGURE 6: BUTTON INPUT CONCEPT

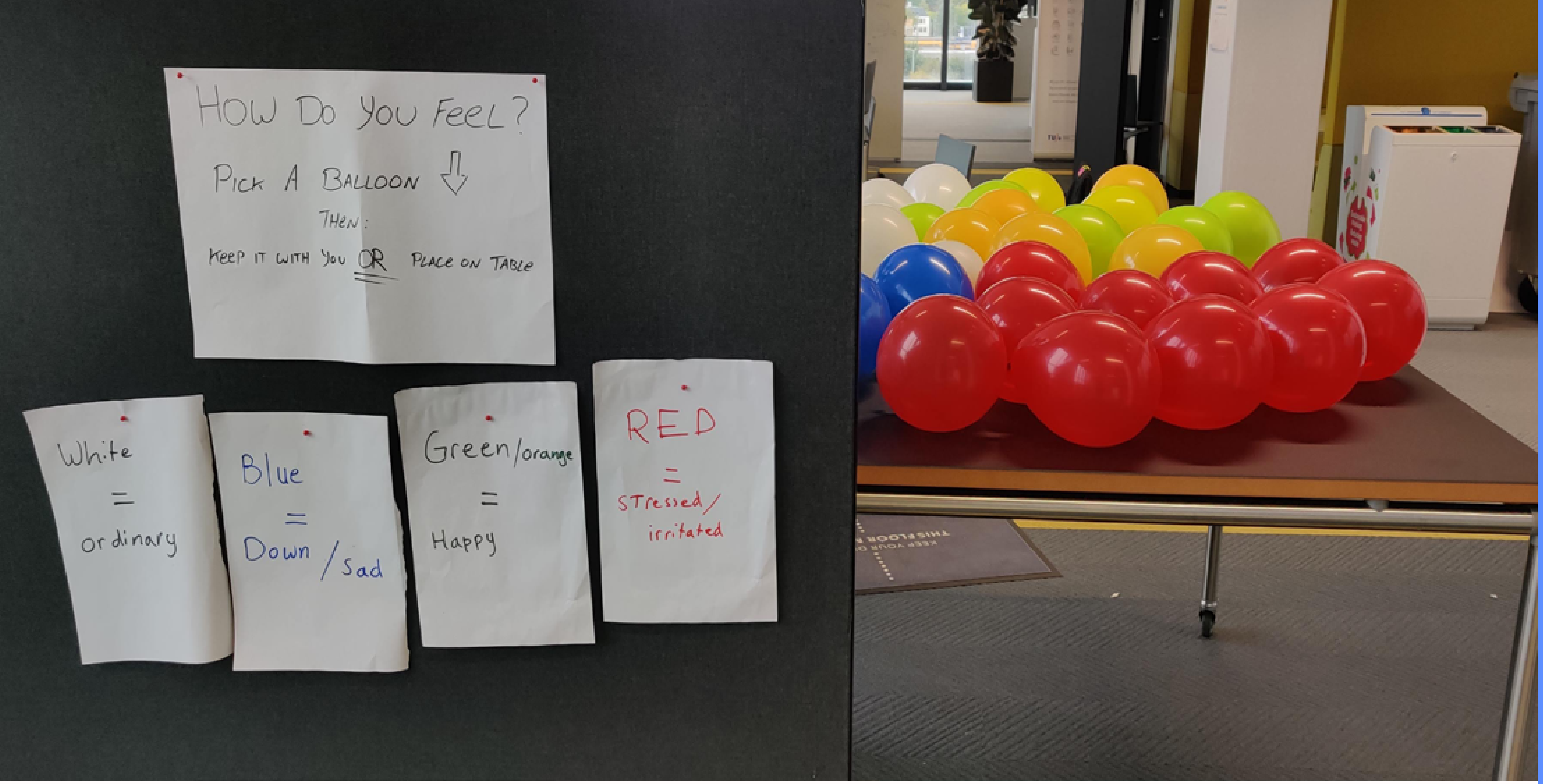


FIGURE 7: PHOTO OF BALLOON TEST SETUP

PRELIMINARY USER TESTING (OBSERVATION)

To gain insights on the current concept created, a comparable setup was made to observe the effects of the current design. This method was chosen to see how the current design would influence the participants in their behaviour when used in a working space. In this way, there could be adjustments in an early stage of the design process to prevent big problems and therefore getting stuck in a later stage of the process. Several tools were chosen to set up this observation as well as possible.

First, the location for the setup was being selected. The concept was envisioned in a working space of roughly 30 people and a similar place had to be chosen to give the most optimate representation. Therefore, a university working space where roughly 30 people were going to be present was chosen. The feelings input of the users would be represented by getting a coloured balloon (where a colour represented a feeling via a cheat sheet) and putting it on the common table where the meeting was held.

Then, the location of the table where the balloons would be taken was selected. This was chosen to be right at the entrance so it was clear that the balloons had something to do with the meeting inside the working space (Figure 7). A sign was also placed next to the table with a short description that stated that each balloon colour represented a feeling (for example red represented stress and blue represented sadness). A neutral balloon (white), which represented nothing, was also added to the table. This was done to see how many people would rather not share their feelings or be a part of this concept. The sign also said that a balloon could be picked up and be either held with the individual (less privacy) or placed on the table in front of the group (more private).

The goal of the observation was to see what the effects were of feelings being represented in the room and also if these feelings were rather kept private or if users didn't mind if their feelings were being exposed to others.

RESULTS

Observations were that everyone was willing to grab a balloon. Exams were coming up, so a lot of students were choosing the red balloon (which represented stress) even though they could have chosen a white balloon (which meant nothing / not wanting to show feeling). Another observation was that some people were grabbing multiple balloons to indicate that they were feeling multiple things, for example, stressed and sad. This led to insight as an iteration in our concept users could not only be filling in their feelings in the form of categories, but also personalise his or her more detailed feeling to give a better representation.

Another insight was that almost everyone kept the balloon with them instead of putting it on the table in front of them. This also led to conversations about the choosing of the balloon. Some people grabbed a balloon, walked to their group and therefore started explaining right away why they chose the balloon and what was going on. This led to an insight that representing the feelings in the form of colour in the working space was leading to a conversation about feelings and therefore taken into account during the meeting.

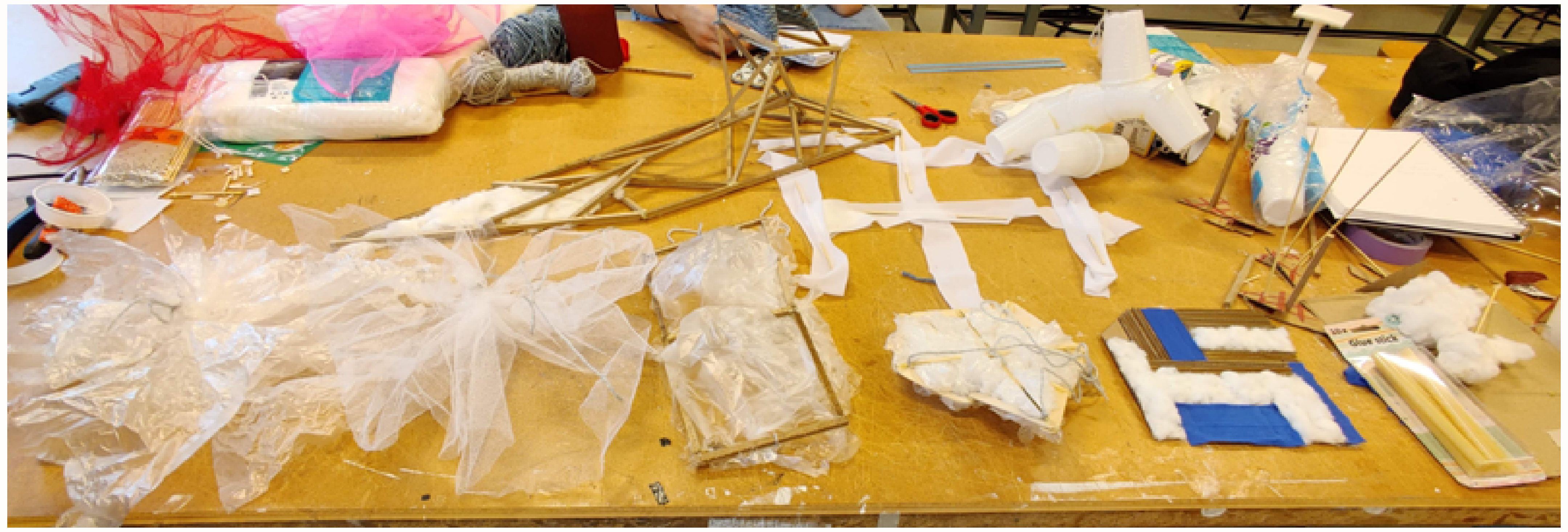


FIGURE 8: RESULTS OF WORKSHOP SESSION

DESIGN EXPLORATION

Arguably the most steps taken in Creativity & Aesthetics happened during a session in the Student Workshop, as we explored many different forms and designs that could be used for the design of an ambient cloud. Using various materials such as wood, wool, plastics, paper, tape, and glue, numerous wildly different forms were crafted. The designs differed in their aesthetics and dynamics – some were made to be static, while others could be used more dynamically. The results of the session can be viewed in (Figure 8), where an overview of the design explorations is given.

To form the appearance of the cloud, inspiration was taken from a mood-board (Appendix A) that was created, composed of pictures of modern ambient office art such as lighting, sculptures and plants, in order to design an object of which the aesthetics would conform to modern standards. In this way, the design would have a more professional look and fit better in a working environment. The insights of the board were used to create a design that combined 'traditional' materials, such as wood and wool, with a more modern look. The cloud was formed using a foundation of small wooden beams, connected in a criss-cross manner, then inlaid with wool to form the soft look of the cloud. This design was later upscaled to form the basis of the midterm prototype. (Figure 9)

FIGURE 9: FIRST ITERATION OF CLOUD PROTOTYPE

MIDTERM DESIGN

During the midterm, we presented our preliminary design, called Cloudia, to convey our idea to the coaches and peers. This resulted in feedback that we could use to improve our design. Our midterm concept consists of two different clouds: a small one that gathers the data and a big one that shows the data visualisation. The small cloud gathers data of each employee entering the office. By pulling down certain 'emotion raindrops' the user can indicate their feelings. The further a raindrop is pulled down, the stronger the emotion. Emotions can be nuanced by pulling down multiple raindrops. These raindrops are hanging from the small cloud at the entrance of the office (Figure 10a).

This data will then be stored in a personal identifier. When entering the working space, the identifier will communicate the data with the nearest big cloud, seen in Figure 10b. This big cloud then shows the common feeling of that whole working space, so all coworkers at that time in that space. So every coworker contributes to the colours of the cloud. Then, if a coworker leaves one space and goes to another, his emotional share will leave the one cloud and transfer to the big cloud in the other room, for example, the meeting room. That cloud once again shows a combination of all the emotions of all the colleagues in that room.

Cloudia should make the workers aware of the emotions that are 'hanging' in the space and preferably stimulate the workers to start a conversation about this (Figure 10c), which in the end should improve their (team)work and mental and general wellbeing.

We also presented a prototype of the small cloud that would eventually become the base model for the functional prototype (Figure 11). The pulling down of the raindrops worked, but the prototype lacked the data gathering mechanism. The cloud was made out of MDF plywood and filled in with synthetic cotton. We chose this because this was the most aesthetically pleasing cloud test we made during our session in the workshop.

FIGURE 10: DRAWINGS OF CLOUDIA CONCEPT

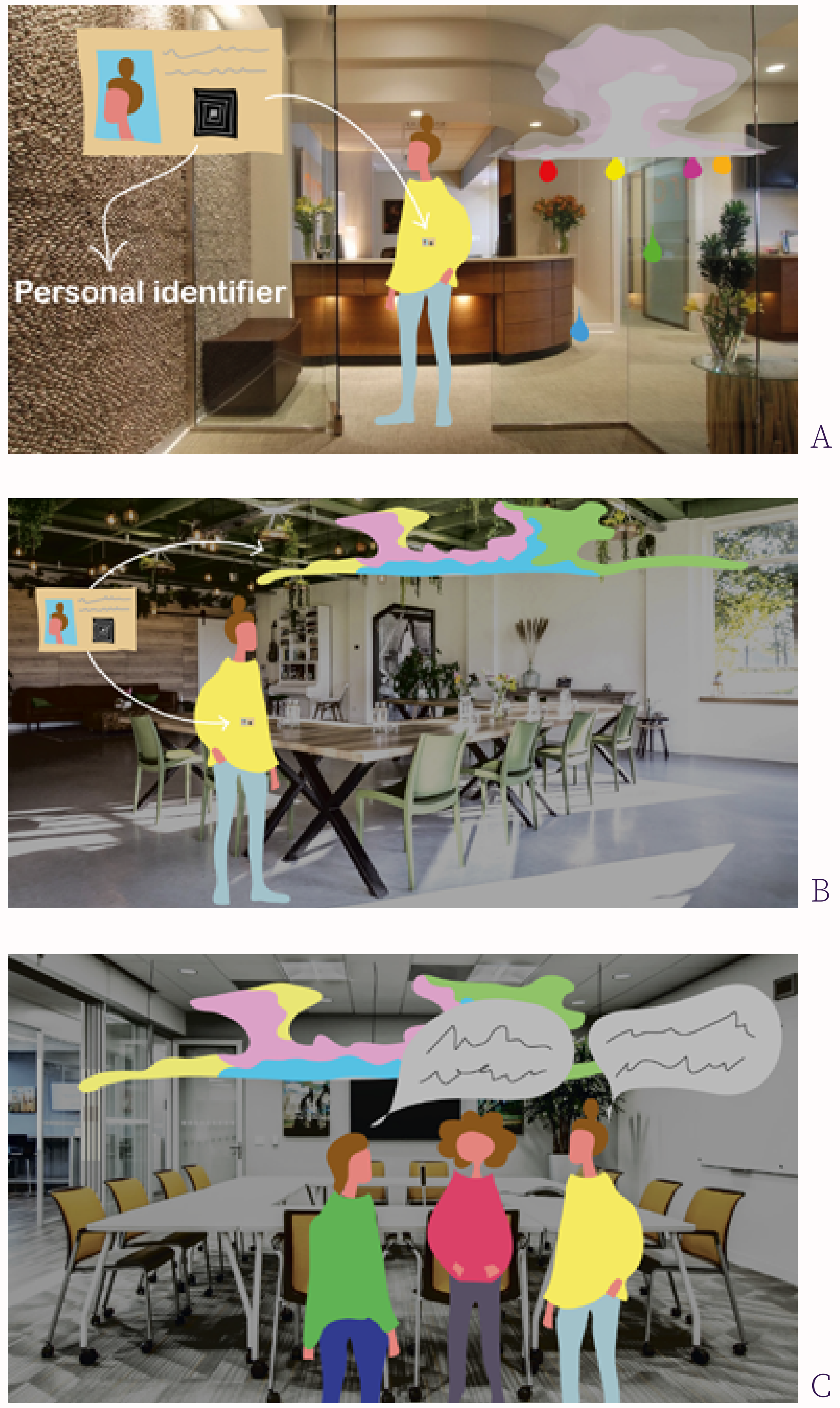
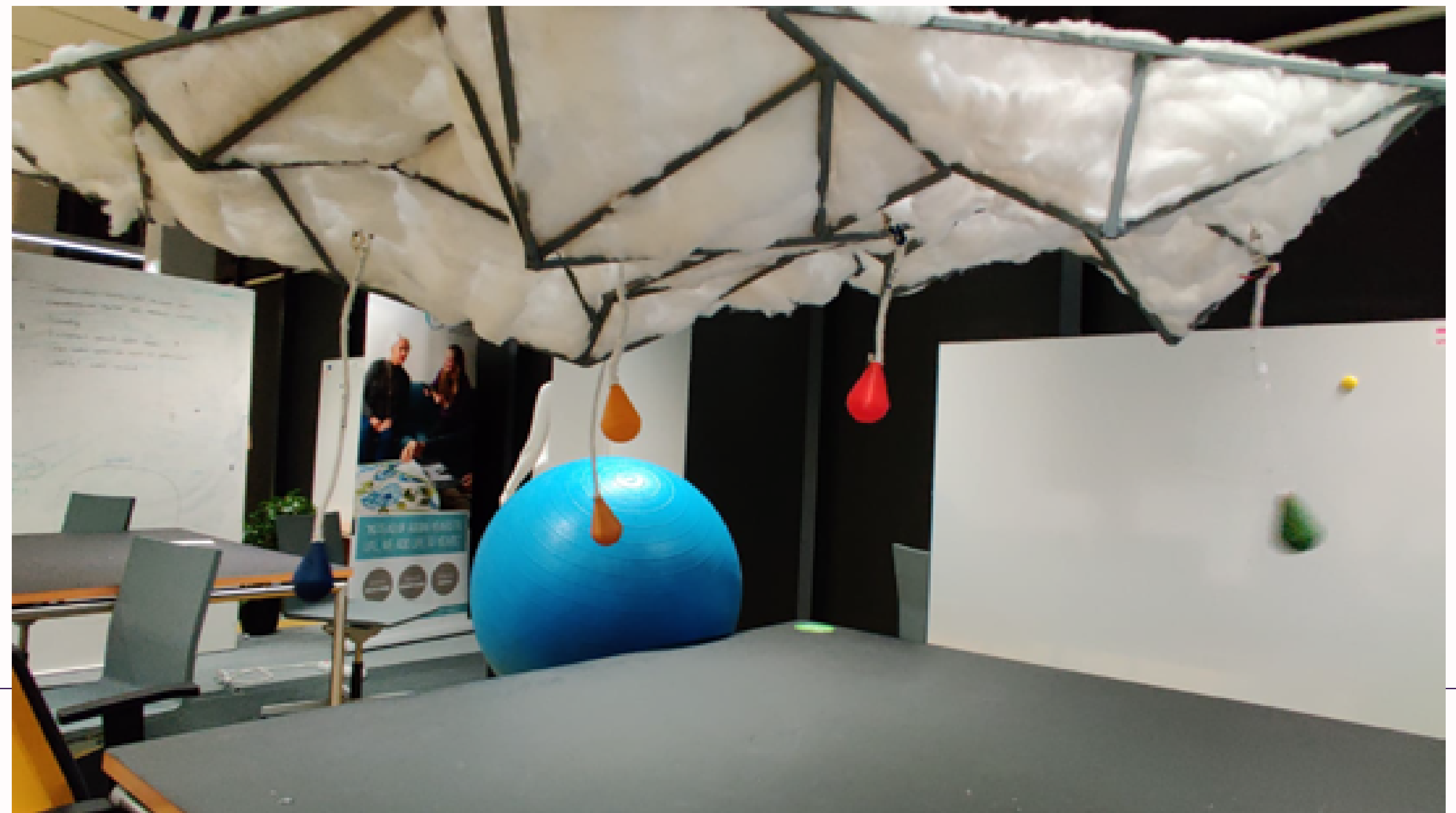


FIGURE 11: SECOND ITERATION CLOUD PROTOTYPE



COLOURS & EMOTIONS

A discussion point that came up repeatedly had to do with representing emotions through colour. Whether certain emotions can be accurately conveyed using colour has long been subject to research. It seems that, even across cultures (D'andrade & Egan, 1974), there is a strong correlation between colour and perceived emotion (Epps & Kaya, 2005), referred to as a type of synesthesia. Certain colours are found to be chosen more frequently to indicate a certain emotion than others, with no distinction between sexes (Wexner, 1954). Colour associations may still differ between cultures, however, as evident by the association of death with black in Western cultures and white in China (Saito, 1996), and personal experience may play a part as well (Epps & Kaya, 2005).

The colours green, yellow and blue are most often attributed to positive feelings (happiness, comfort, peace, hope), whereas red is the preferred colour to associate with anger (Epps & Kaya, 2005).

Thus, colours can definitely be said to be linked to emotion, but the exact meaning of these emotions can differ from person to person. Therein lies the challenge of using colour-emotion synesthesia. If we, as designers, were to decide on which of the raindrops indicated which emotion by putting up a sign, then the majority of the office workers would find these choices agreeable. The collective feelings of the workers would be clear to all, since everyone would know that red equals stressed and blue equals happy. In this case meetings can also be steered to increase workflow and could also lead to conversation. For example, if there is a lot of stress visible in the cloud, the meeting can be stalled or the visible common stress emotion can be discussed and maybe even, by talking about it, reduced.

However, the goal of the project was to raise awareness on personal feelings and to stimulate conversation about emotions in the workplace. One way to achieve this would be to leave the colour-emotion associations up to interpretation. This would mean that a discussion is necessary in order to figure out what everyone is feeling - stimulating deeper conversations about more complex feelings. Instead of categorising their emotions, the workers could simply express what they feel in a more natural way. The downside of this, is that it could potentially lead to more confusion than resolve, to the point where people no longer wish to use the device.

FIGURE 12: COLOURED RAINDROPS AND ASSOCIATED EMOTIONS

In the end, we opted for having the colour-emotion associations be fixed (Figure 12). This method provides clarity to the office workers, and makes the function of the design concept more clear and intuitive as well. There still would be the need to talk to each other, to find out who is feeling what emotion, but even without conversation there will be a heightened level of awareness about the emotional state of the office space.

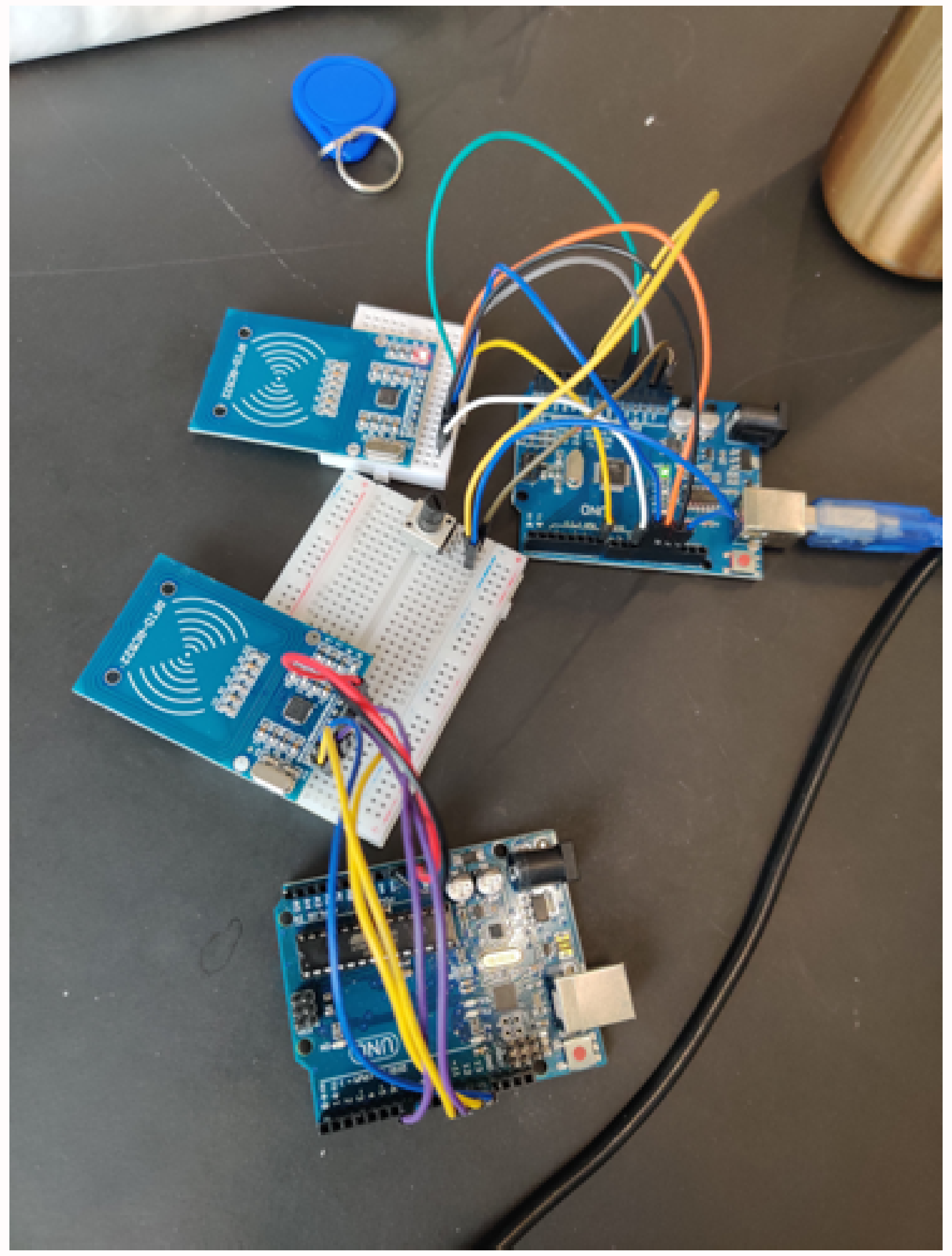


FIGURE 13: NFC TEST SETUP

DATA TRANSFER

One of the aspects of the concept that had been in development was a way to transfer the data from the data gathering cloud to the visualisation cloud. At first, this would be done using a wireless connection between both clouds. However, upon testing it became apparent that such a system would be difficult to realise, as well as unreliable on a large scale. Instead, it was decided to use NFC tags that the office worker could carry with them around the office. After expressing their feelings with the data gathering cloud, they would scan their personal card so that their data would be uploaded to the card. Then, upon entering a certain room of the office, the card could be scanned and read so that the data could be uploaded to the correct visualisation cloud – the one in the same room the office worker was in.

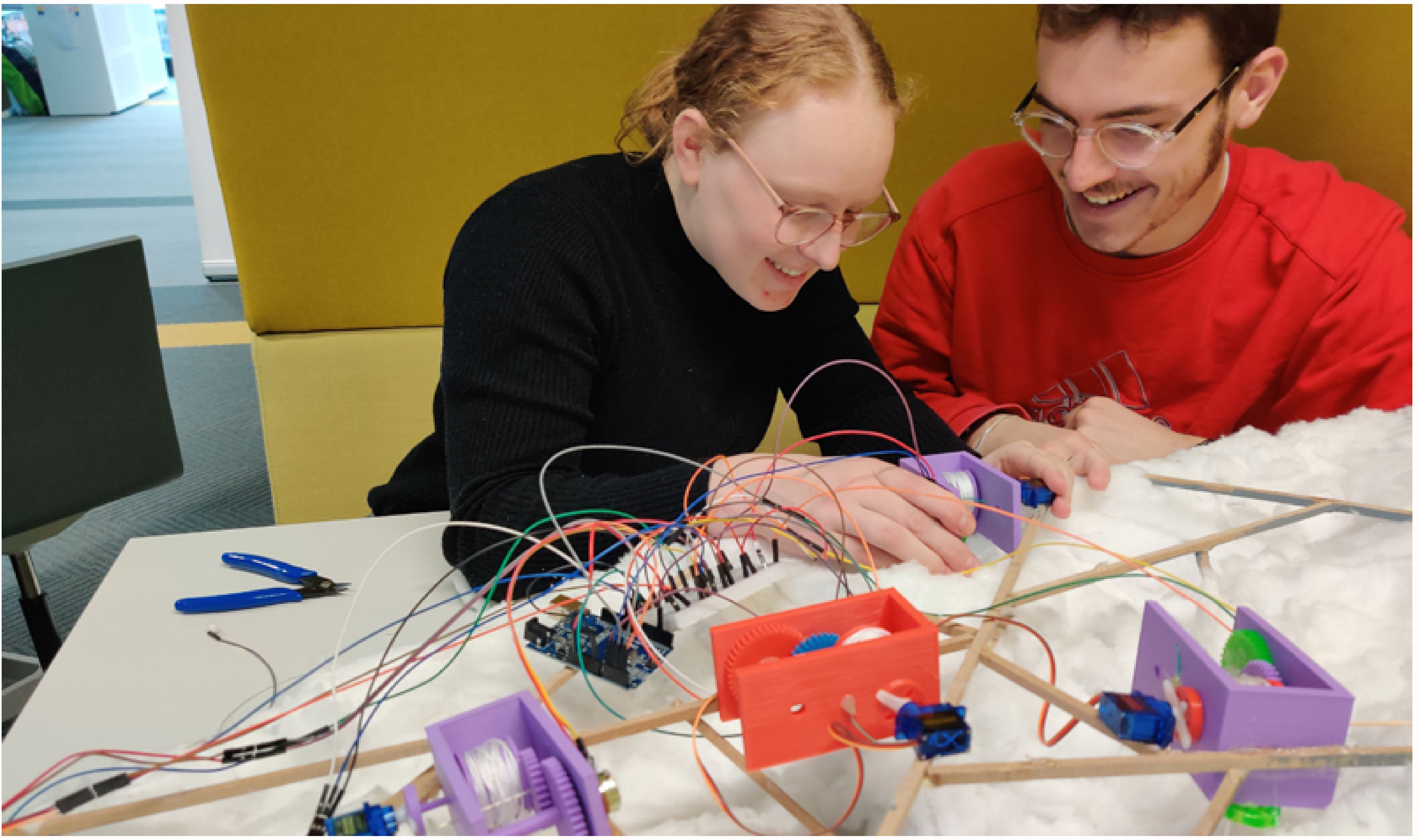
This aspect was tested using a setup of two Arduino Uno's, both with an MFRC522 reader/writer module, a corresponding tag and 5 rotational potentiometers (Figure 13). After arbitrarily turning some of the potentiometers (giving 5 independent integer variables as input) the NFC card could be scanned, at which point the integers would be converted to bytes and stored into fixed 'blocks' of the NFC container. Then, when reading the card using the other Arduino, those same values could be read and visualised.

The system worked well and could be used to test on a large scale, however, when it later became known that it would not be possible to conduct a large-scale user test (see Evaluation, p.10), the aspect was scrapped in favour of a more straightforward version of the prototype, due to having become redundant; when testing on a small scale, with both the data gathering and data visualisation cloud in close proximity, the data can be sent directly from one to the other without the need of an additional 'messenger' such as the NFC tag.

PROTOTYPE MECHANISM

For the midterm prototype, retractable keychains were used to make it possible to pull the drops down and then return to their original place after letting go of them. This was, however, not a great user experience, since the user had to give a lot of force and the drops were uncontrollably shooting up. This occasionally led to damage to the prototype and the raindrops could even hit the user - neither of which is desirable. Another insight of the midterm prototype was that the cords were rather short. Lastly, the data of pulling a cord down had to be collected in some way, which was not yet the case in the midterm prototype. We therefore improved the design further by focussing on the expertise areas “User and Society” and “Technology and Realisation”.

FIGURE 14: BUILDING THE FUNCTIONAL PROTOTYPE



First, a way of data gathering by cord was being researched. A few possibilities came up online on, for example, Arduino community platforms. Then, some further research was done by choosing another method. We talked to an expert, Günter Wallner, who could help us with some advice on what sensors and actuators to choose. After going through these methods, we concluded to use a rotary encoder, which would be attached to a string (Figure 15a). By pulling the cord, the rotary encoder would track how far down the drop was going. The cloud was meant to hang a bit above the mean user height (on approximately 2 meters) so the users are looking at the cloud from a frog perspective to achieve a nice aesthetic. The user should be able to pull the cord, with the drop hanging from it, as far as they want (all the way to the ground) to indicate how strong the feeling is. A benefit of the rotary encoder was that it could turn continuously which meant that it was possible to pull the cord approximately 2 meters down and read the data.

There was now something needed to pull the cord up afterwards. A continuous servo motor was selected for this task. The idea was to put a 3D printed part between the rotary encoder and the servo motor (Figure 15). On this part, the cord will be placed so it turns with the rotary encoder and the servo motor. A downside to this design was that, if the power was cut off, the rotary encoder wouldn't know its absolute position and take its current position as the new beginning position. Another downside was that the rotary encoder doesn’t work in steps. This had some consequences on the coding with regards to telling the servo when and how far to pull the cord up again. This is why there was a switch to a simple photometer. These could however not turn continuously, so a gearbox needed to be designed since the cord needed to be fully pulled down. Research was done on gears (like what the best gear teeth form to use was) and how to calculate with these to get the right amount of rotations. Eventually, the gear ratio formula (gear ratio = driven/drive) was used, together with the requirement of the cord being approximately 2 meters, to conclude.

First, there was an outcome with 2 gears that were too big to be placed in the small cloud, which meant that double gears were necessary. To create something smaller, 3 gears were needed: a gear with 8 teeth, a double gear with 6 teeth on a 32 teeth gear and a 42 teeth gear (Appendix C). Furthermore, the 8 teeth gear needed to have a part where the cord could be rolled up. Additionally, a box needed to be designed to keep everything in place - this was done in Fusion360 (Figure 16). After this, the code could be made and the mechanism was ready to be tested. The potentiometer and the servo were going to be steered by an Arduino UNO and later on connected to a visualisation code in Processing.

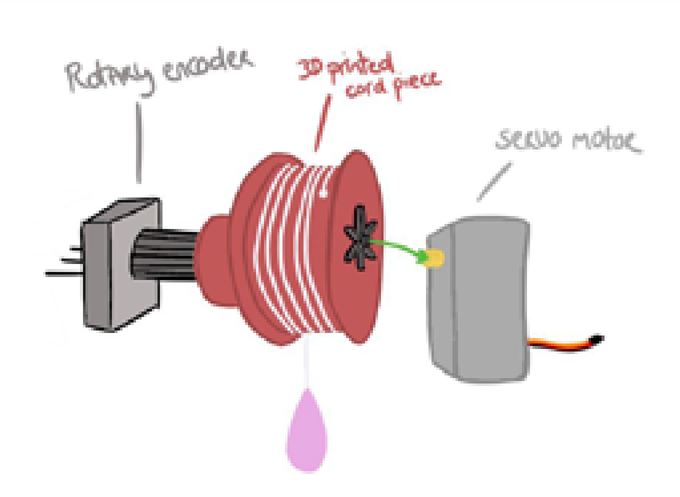


FIGURE 15: DIAGRAM OF RAINDROP MECHANISM

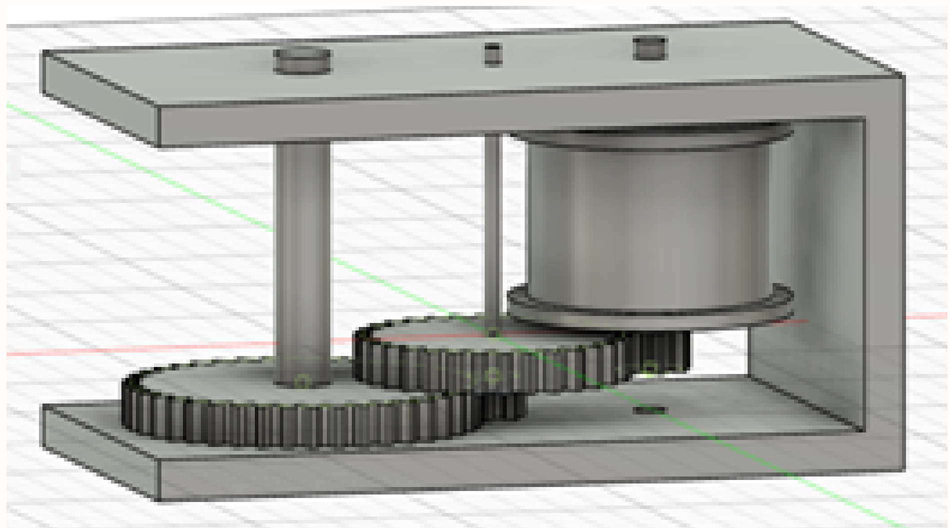


FIGURE 16: 3D MODEL OF GEAR-BOX

After printing all the parts and testing them, the conclusion was that some axes, which should hold the gears, were too small to be printed. They would also have been too weak and broken if the mechanism started rotating. Therefore, some improvements were needed. First, a needle was used to keep the middle gear (32/6 teeth gear) in place, but because of the material, it kept slipping away. Instead, we used a wire with plastic protection and glued this to the gearbox to keep the middle gear in place. Sometimes the gearbox was still jammed, which had to do with the 8 teeth gear. Because of the weight of the cord and the 3d printed gear itself, it started hanging at a slope which led to not connecting with the rest of the gears. This is why extra support was placed to keep the right axed of the 8 teeth gear intact. Another problem was that the servo motor couldn’t be attached since there was not enough surface available. This is why the pin attached to the 8 teeth gear was also adjusted to have a greater surface to attach to the servo motor (Appendix D). After these adjustments, the gearbox worked a lot better with the right amount of resistance and the right distance of 2 meters to pull the cord down.

After putting everything together, the midterm prototype was modified to inlude the mechanisms, which gave a good representation of the concept with the use of: an arduino, potmeters, servo motors, some 3d printed parts and processing (Figure 14).

CONCEPT

IN DETAIL.

FIGURE 17: VISUALISATION OF 'BIG' CLOUD (SIMULATED)

The final concept of Cloudia consists of two major elements: a big cloud (Figure 17) and a small cloud (Figure 18). The small cloud will serve as a data collector cloud where the feelings of the users will be filled in. This cloud would be placed at the entrance so the bar will be set as low as possible for the users to fill in their feelings, since they are walking by the entrance anyway, to optimise user experience. Extra small clouds could be installed in common places like the hallway or the canteen so users can update their feelings during the day.

Next to the cloud, a sign would be placed, explaining each colour of the raindrops hanging from the little cloud (based on the research about association between colours and feelings). To fill in the emotion, the user connects the app with the small cloud and pulls the drop, which represents their emotion down. This would give a playful experience because of the pulling of the colourful drops and seeing them hang in a pattern that the user creates him or herself. The cloud is programmed in a way that the further the colour is pulled down, the stronger the feeling will be stored.

Furthermore, for better user experience, resistance will be noticed when pulling the drop-down so that the user has instant feedback of doing something to the cloud and filling in their data. When a user is feeling a more complex emotion, multiple drops can be pulled down, leading to a more personal and accurate data representation.

After pulling a drop down, it will be set at this height until the user is done pulling all the cords they want. In this way, it is also much more clear to the user themselves what they have filled in. To again set the bar as low as possible, the personal data will be stored in the app. The app will be able to locate the area you are in and in this way share the data via Bluetooth with the big cloud which is closest to the user.

The big cloud will serve as data visualisation. In every distinct workspace, there will be a big cloud hanging from the ceiling, displaying the common feeling of all the users present in the room. It will represent these feelings by creating colour clusters. These clusters would clearly show that one feeling is more present than the others.

The big and small clouds are designed in the same style, such that it is more clear for (new) users that the two are part of one concept. The movement of users walking in and out of the rooms will lead to constant colour changes in the big cloud. This would keep the ambient display interesting for users to look at, besides common curiosity, during the day. This concept should lead to an understanding of the common emotion during a working day. Understanding the emotions should then again lead to possible conversation which means that unspoken problems are reduced. This should improve (team)work and mental and general wellbeing.

To see the concept in action and to better understand how all aspects relate to each other, the video can be watched using the link in (Appendix B).

FIGURE 18: FUNCTIONAL PROTOTYPE OF DATA GATHERING ('SMALL') CLOUD

Similar to the final concept, the final prototype consists of two parts: The small cloud prototype and the projected visualisation. These two parts can be seen in Figure 19. Connected to the cloud are 5 raindrops. These can be pulled down to express emotions. Each raindrop symbolises a different emotion. By pulling down a raindrop the user will input data. A potentiometer is measuring the length, this data will be sent with an Arduino to Processing to make the visualisation. To give the raindrop a maximum length of approximately 2 meters, we designed a gearbox that converts the 180° motion of the potentiometer to a 2-meter pull (Figure 16). Then, after a few seconds of no movement, a servo motor will wind up the wire and the raindrop will be hoisted up to its original position.

The data from the potentiometers is sent to a custom Processing program, where the colours of the pulled drops are displayed on a screen. The amount of each colour present in the image directly corresponds to the percentage of that emotion in the total amount of emotion 'units' (a full rotation of the potentiometer gives an integer between 0 and 70 - this mapping was chosen to minimise noise). So, if the red raindrop is pulled halfway and the blue drop is pulled all the way down, Processing receives a signal of 35 units for 'Angry', 70 units for 'Happy', and 0 units for the remaining emotions. These units are added to the total sum of emotion 'units' of that time period. While the initial concept used clusters of colour for the visualisation (Figure 17), this was not accomplished in the time we were given for the Demo Day. Instead, the displayed image shows a random distribution of all the colours, where each colour has a probability to be rendered, equal to the percentage of its 'units' in the total amount of emotion 'units'. The output image then displays approximately 67% blue, and 33% red colour (Figure 19).

To create an appealing exterior of the cloud(s) we used MDF (plywood) and synthetic cotton. The frame of the screen on which the projection is also made out of MDF, then the cotton balls got woven around a chicken wire mesh to create the screen. The raindrops are 3D-printed and then painted in the appropriate colours. The gearboxes are 3D-printed as well.

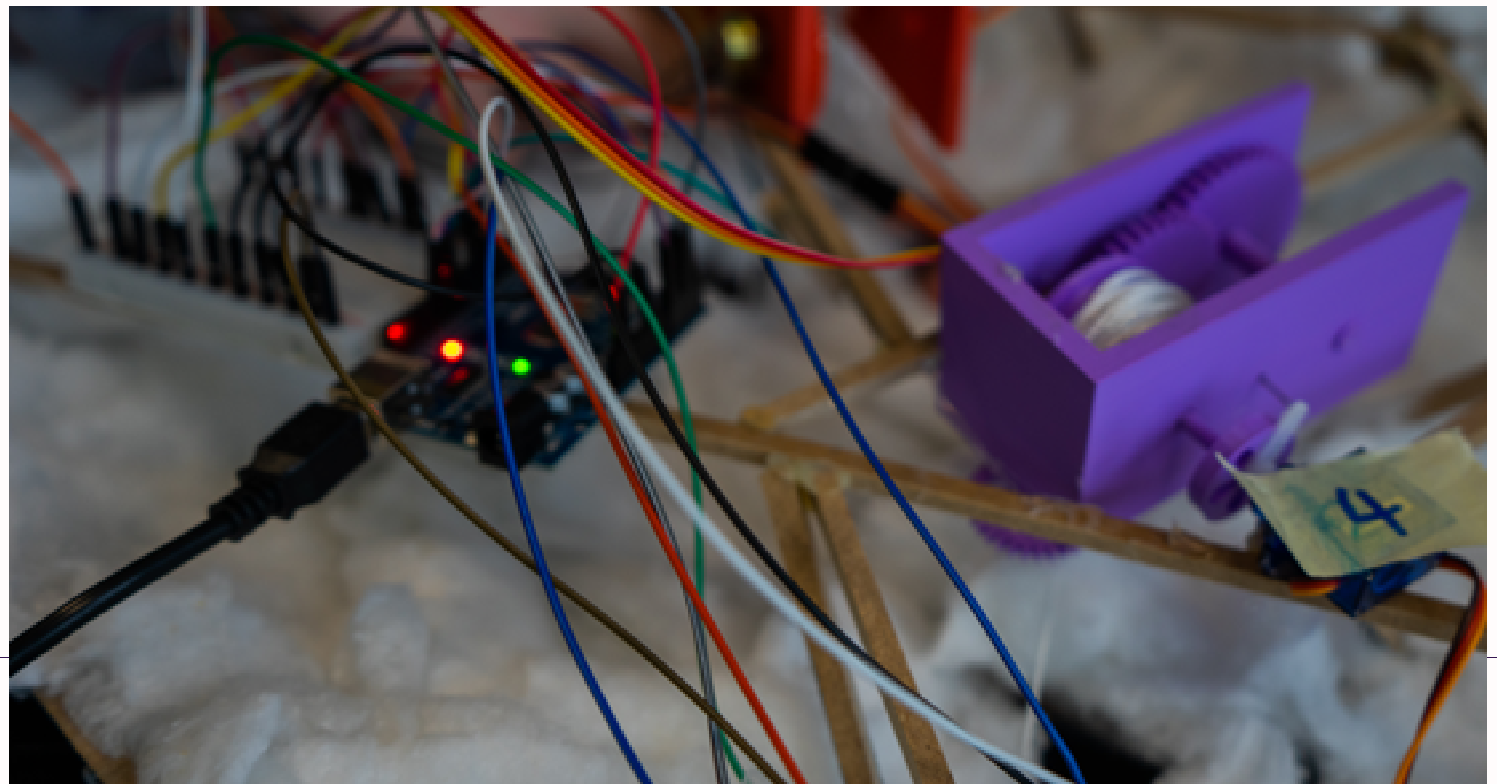


FIGURE 20: CLOSE-UP OF ELECTRONICS AND RAINDROP MECHANISM

FIGURE 19: OVERVIEW OF DATA GATHERING AND VISUALISATION CLOUD PROTOTYPES

Unfortunately, a week before the demo day the prototype caught fire and got completely destroyed (Figure 21). This was a huge setback. All the electric components were fried and the 3D printed gearboxes were melted. Luckily, we already took some videos and made nice product pictures. However, this was a great learning opportunity and we like to see it as a forced iteration. Because this allowed making some changes, which made the prototype work better. We changed the position of the potentiometers and upgraded the axis of the gears. But most importantly, we attempted to make it more fireproof. We added foam board in between the components and the synthetic cotton, to prevent another fire if we got a short circuit. Unfortunately, we cut down on scale because of the time constraint. We only made 3 working raindrops instead of 5 (which we initially planned on).

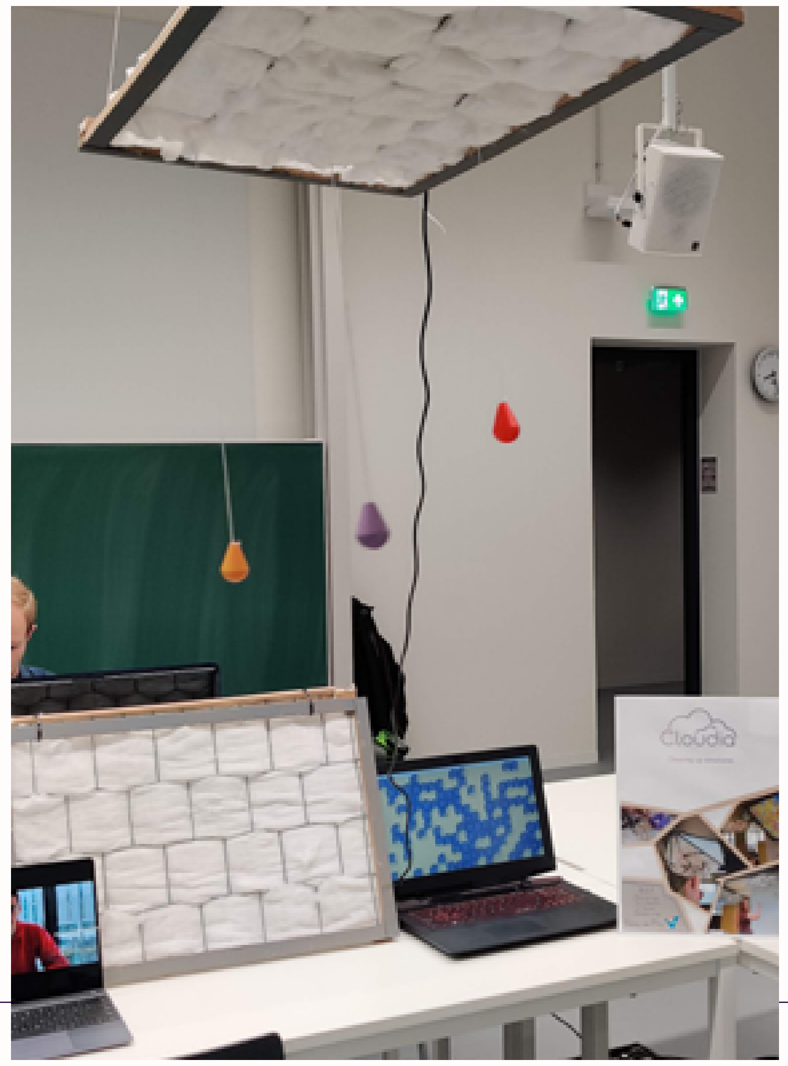
FIGURE 21: DESTROYED PROTOTYPE

EVALUATION

TESTING AND PEER REVIEW

We planned to conduct a user test but we encountered a lot of problems since the COVID situation was getting worse and leading to a lockdown. First, we tried to test our product at companies in the region of Eindhoven, we sent emails to about 15 companies. Barely any replied and the ones who replied said that COVID impacted the companies by stimulating work from home or that they were not interested. Then we started to look at alternatives. Regina, our project coach, advised us to search within the TU/e. We tried PhD student groups, but this did not work out since they did not work at the university anymore due to the pandemic. Then we planned on doing the user test with different project groups in our circles. Once again we got in trouble since the university closed down because of the COVID lockdown. So nobody had physical meetings on campus.

FIGURE 22: OVERVIEW OF DEMODAY SETUP



DEMO DAY

Since it was no longer possible to conduct a user study in the way we would have wanted to, we were fortunate to have a physical Demo Day with fellow students and staff. This allowed us to probe reactions to, and comments on, the Cloudia prototype. The setup was as follows: the prototype with the raindrops was hung from the ceiling and directly connected to a laptop, on which the data visualisation program was run. Next to that were another laptop playing the final video, another model of the prototype, serving as a placeholder for the 'big' cloud, and a poster (Figure 22).

FIGURE 23: STUDENT PULLING RAINDROP | PHOTO BY LIEKE VERMEULEN

Some comments we received were related to the friction of the raindrops – having some feedback on the pulling of the raindrops was well-received. To the users, the resistance indicated that what they were doing had an actual impact – making them more aware of the data they were putting in. There was some uncertainty regarding the colours of the raindrops, however. It was unclear whether the colours represented a fixed set of emotions, or if the user was free to decide what each colour meant. This brought up the discussion that had resurfaced repeatedly during the design process, bringing up the pros and cons of either argument. It solidified the notion that the subject is indeed as divisive as expected.

A recommendation was given about incorporating the 'small' data gathering cloud into the 'big' visualisation cloud, by letting the height of the raindrops be representative of the amount that that drop has been pulled. This way, the data gathering and visualisation would become more unified, displaying a clear correlation between the two. This is a more simplified version of the concept we had not considered yet, but seems to be more efficient by making the second cloud redundant. If the project were to be continued it could definitely be worth considering.

There are, of course, notable flaws with the setup of this evaluation. The only thing that could be tested was the initial reaction of the users, whereas the concept is built around long-term use.

FIGURE 24: DISCUSSION NEXT TO THE CLOUDIA PROTO-TYPE | PHOTO BY LIEKE VERMEULEN

CONCLUSION

WRAPPING UP

We have had to endure some hardships; our prototype catching fire, missing a teammate for a long while, and the pandemic did not help either. Regardless, we are happy with the concept and the prototype we came up with and what we delivered. We would have done things differently when looking back on our process, but unfortunately we cannot change this. However, we think that Cloudia could be beneficial to companies and their employees. Our concept will help to discuss (negative) emotions and by doing that the mental health of the employees and the productivity of the company.

Like described in the evaluation, we would have liked to conduct a user test. But we could not make it happen, mainly because of COVID. We find this very unfortunate, because we had been working towards a user test from the beginning of the project. If we were to have had more time on our hands, we would have planned a user test much earlier to validate the working of our final prototype and concept.

Secondly, with more time, we could think about different alternatives to making the pulling mechanisms work in a better, more robust way. An expert told us that this was an easy method of doing it. But looking back it provided a lot of struggles. Choosing a different technique would have possibly made it easier for ourselves.

REFERENCES

D'andrade, R. & Egan, M. (1974). the colors of emotion. American Ethnologist, 1: 49-63. https://doi.org/10.1525/ae.1974.1.1.02a00030

Epps, H. H. & Kaya, N. (2005). Color-emotion associations: Past experience and personal preference. AIC 2004 Color and Paints, Proceedings of the Interim Meeting of the International Color Assoication, Porto Alegre, Brazil, 3-5 November 2004, ed. By José Luis Caivano. Retrieved from: www.fadu.uba.ar/sicyt/color/aic2004.htm, pp. 31-34.

Wexner, L. B. (1954). The degree to which colors (hues) are associated with mood-tones. Journal of Applied Psychology, 38(6), 432–435. https://doi.org/10.1037/h0062181

Saito, M. (1996). Comparative studies on color preference in Japan and other Asian regions, with special emphasis on the preference for white. Color Research and Application 21 (1): 35-49.

Gopinath, R. (2009). Employees' Emotions in Workplace. Research Journal of Business Management, 5(1), 1–15. https://doi.org/10.3923/rjbm.2011.1.15

Bernhaupt, R., Boldt, A., Mirlacher, T., Wilfinger, D., & Tscheligi, M. (2007). Using emotion in games. Proceedings of the international conference on Advances in computer entertainment technology - ACE '07. https://doi.org/10.1145/1255047.1255056

Henderson, M., Harvey, S., Øverland, S., Mykletun, A., & Hotopf, M. (2011). Work and common psychiatric disorders. Journal of the Royal Society of Medicine, 104(5), 198–207. https://doi.org/10.1258/jrsm.2011.100231

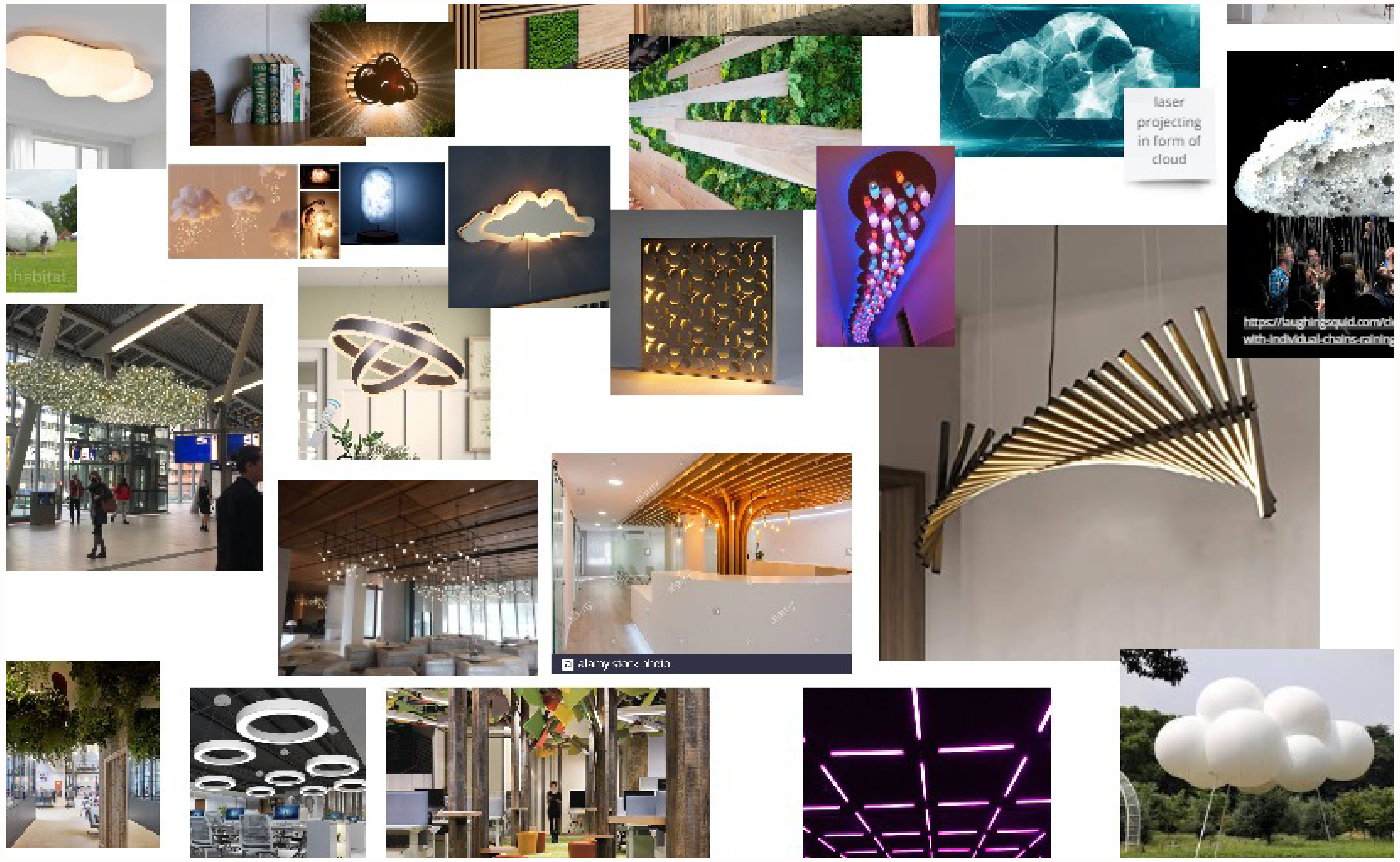
Corné A. M. Roelen, Rob Hoedeman, Willem van Rhenen, Johan W. Groothoff, Jac J. L. van der Klink, Ute Bültmann. (2013). Mental health symptoms as prognostic risk markers of all-cause and psychiatric sickness absence in office workers. Oxford University Press on behalf of the European Public Health Association. https://academic.oup.com/eurpub/article/24/1/101/492131?view=extract

Odell Keller, (2019). The "HOW MIGHT WE" Method. https://www.odellkeller.com/the-how-might-we-method/

Teplizza, (n.d). Image-ination. https://teplizza.com/tools/generating-insights-brainstorming/image-ination/

www.tinkercad.com

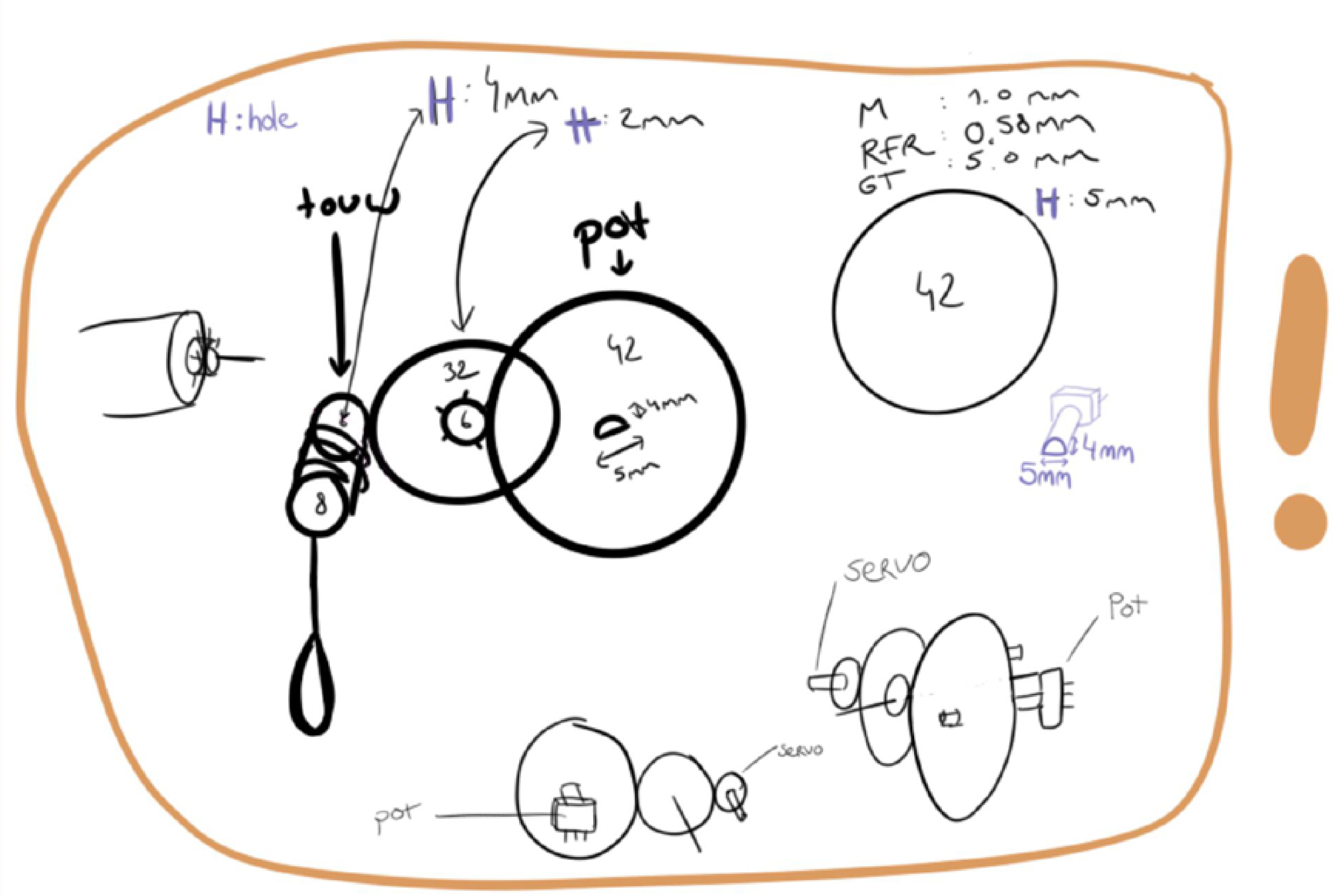
APPENDIX



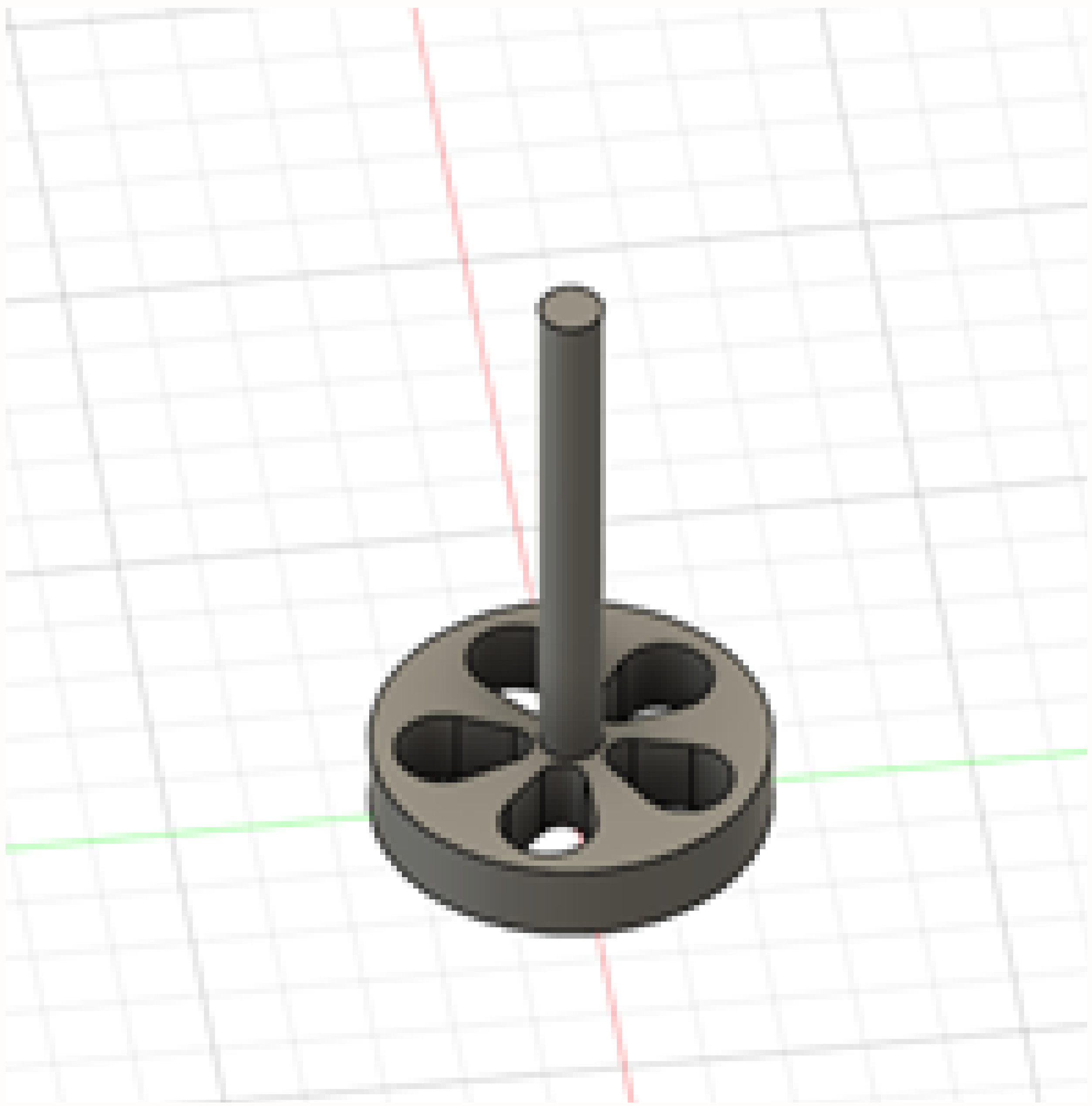
APPENDIX A: SCREENSHOT OF THE CREATED MOODBOARD

APPENDIX B

LINK TO VIDEO: HTTPS://WWW.YOUTUBE.COM/WATCH?V=BGLO2GEXQEC



APPENDIX C: CALCULATIONS OF GEAR RATIO'S



APPENDIX D: MODIFIED PINFUSION360