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# DESIGN SPRINT WEEK EVALUATION

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Intelligrid Project, Roskilde University

## Abstract
This working paper gives an account of the development of a first prototype of an App to be used by households to control their appliances thereby using available regenerative energy in a more efficient way. We give an account of different types of prototyping and why we choose to carry out a design sprint. We tell how and why we did what we did in the Design Sprint in June 2020. We present process and product design learning outcomes. And finally we show a picture gallery from the process as well as illustrations from the prototype

# Contents

## Introduction

The idea behind the IntelliGrid project is to use available regenerative energy in a more efficient way. The demand of electrical power is not constant over the course of a day. The same applies to the production of electric energy and its availability in the power grid which fluctuates during the day for different reasons. It could be a very sunny day or the wind blows strongly, generating more power than can currently be used. Rather than switching the wind turbines off and "losing" the power, would it not be more efficient to switch on additional consumers? This is the idea behind the IntelliGrid project. Using the electrical power in the grid when it is available.

As part of the IntelliGrid project the team at Roskilde University set out to design the first prototype in the last week of June 2020. The design was based partly on a literature review, partly on lead user interviews carried out in the spring of 2020 in Denmark and Germany.

The purpose of building a prototype was to evaluate a concrete artefact in the shape of a navigable prototype that was tested and evaluated by real, potential users to establish learning about the users, context as well as the limitations and opportunities of the proposed technology. In our evaluation we aimed for having real users, with real problems, set in a context of real households. A naturalistic setting with 'real, real, real' so to say (Venable, Pries-Heje, & Baskerville, 2016).

We decided to use a technique called Design Sprint (Knapp, Zeratsky, & Kowitz, 2016) to build and evaluate our first prototype. This technique is well suited for trying new things and getting feedback in a very short time – one week. This working paper documents the results.

## Prototypes or prototyping

A prototype is defined as an early stage or edition of a product. It can be digital or physical. Early versions of products have always been a core tool in the designer's toolbox, as it allows to both internally gain an understanding of feasibility, potential and direction as well as give feedback on the designer's initial thoughts.

In its infancy in the digital world, prototyping has proven to be a contention of debate. Some practitioners would think of a prototype of an actual working product, where others would think of the prototype as a proof of concept that gave rise to ok'ing a project. While the contention of doing prototypes nowadays is a lot less prominent and the use of such tools considered completely necessary for successful product development (Jussila et al., 2020) the definitions can still be quite unclear, as well as the purpose of producing a prototype.

Prototypes can be "horizontal"; lacking deep functionality but being largely visual, sometimes with only a deep core focus on navigating an interface or getting an overview of the functionality. In the other end a prototype can be "vertical", denoting a deeper core functionality that is rather confined to for example a single use case or user task (Rudd, Stern, & Isensee, 1996).

Lastly, a prototype can be evolutionary in various stages, meaning that an iterative process builds on the functionality and refinement of the prototype as the design process goes on.

Opposed to this is the idea of ‘throw-away’ prototypes where the prototypes are not meant to be included in the final product but instead used to test out ideas and design hypotheses (Hertzum, 2010).

Contemporary terminologies that encapsulate the concept of “prototyping” include “proof of concept” (Rudd et al. 1996), “minimum viable product”, and many others but are largely similar to the original concept espoused in the late 80s.

Prototyping as a process differs largely from the concept of “prototype”, though. The specific nature of the prototype is largely inconsequential (though of course the definition and aim of achievement as alignment for a design team will definitely help clear up confusions about scope) and instead the focus is on the process; getting people together towards a collective aim with defined roles and a scope has proven to not only speed up the design process but also helped establish stronger relationships and sharing knowledge internally in the team (Nonaka, Takeuchi, & Umemoto, 1996), as well as instigate creative processes that bind designers with users (Dorst & Cross, 2001). The prototyping process in itself ensures that “learning” takes place (Hertzum, 2010) and this in turn will test out whether the prototype is economically viable, technically and organisationally feasible, and desirable of the target audience (Brown, 2009).

For the specific purpose of the IntelliGrid project, we aimed at producing a, prototype with the aim to do iterative changes in the coming months.

## Method

In the following we report on the method that we followed (the Design Sprint technique), how the method was adapted, and finally the limitations of the method.

### The Sprint

The IntelliGrid project team at Roskilde University (RUC) consisting of (in alphabetic order) Frants Christensen, Magnus R.P. Hansen, Jan Pries-Heje and Nadine Sandjo Tchatchoua, set out to perform a Sprint week in order to design an App to be used by households for controlling and monitoring green energy use.

The aim of the Design Sprint was to take the findings from the lead-user interviews (Tchatchoua, Pries-Heje, & Hansen, 2020) as well as findings from a literature study and evaluate in a prototype what and how we could use these findings? Also, the team of four people had different ideas on what inspiration could be found in the vast literature on green IT and sustainability. Hence, we wanted to have alignment of the team’s ideas, including all team members in the decision process for all team members, and getting things done quickly.

The team was inspired to follow the Sprint method by Jake Knapp in his book ‘Sprint – how to solve Big problems and test new ideas in just five days’ (Knapp et al., 2016). The book defines a Sprint as a unique five-day process for answering crucial questions through prototyping and testing ideas with customers. The first day – Monday – is used for mapping and asking experts about opinions. Followed by Tuesday, a sketching day where different aspects of the prototype are produced. Wednesday is for deciding on key functionality. Thursday is for constructing a prototype. And finally on Friday – day 5 – testing and evaluating the prototype with five real users.

We decided, however, to follow an updated 4-day version of a Design Sprint (Smart, 2020) in which Tuesday and Wednesday are grouped together. Also instead of interviewing experts on day 1 our lead user interview findings (Tchatchoua et al., 2020) substituted that.

## 'Sprinting' the first IntelliGrid prototype

During the course of the first week day, the key goal for the RUC team was to come up with a system that enables households to monitor their Green Energy consumption, i.e. using Green energy optimally as and when available - and as it is produced.

The Sprint questions the team set out to answer were:

a. *Can we build a system that motivates and enables long lasting Green energy usage- even when inconvenient? (Rogers,2003)*
b. *Can we build a system that calculates the likelihood of Green energy availability through a plug?*
c. *Can we build a system that connects to ALL appliances in the household?*

With these questions as the cornerstone of the design week, the team began following the Jake Knapp's method step by step activities as described in the book and short videos - sketches, navigation maps etc.- and eventually a prototype was ready to be tested on the final day of the Sprint week. The team took turns to be facilitator for each day, letting each facilitator prepare tools and methods for their own day.

## Limitations during the process

Like with any process or academic study, some challenges arose during the course of the week. These had to be quickly overcome in order to continue with the overall process as described in the book.

First of all, given the fact that the team by and large were new to this particular process, a few stops were required to watch and understand the key constraints for certain activities. This included time outs where the team reflected on the coming activities.

The team furthermore had a lot of experience with the vision and the type of technology since the Sprint was arranged 6 months into the process. This created a need for renegotiating the vision, purpose and scope many times during the first two days. For example, it became apparent that two types of sprint prototypes could be created; one of the mockups and interface of an app, and one that connected data sources and made decisions based on the input. The first being more visual while the latter being more back-end and business logic-oriented.

Time increasingly became scarce in the 2.0 version of the Sprint week that we followed – 4 days instead of 5. The team therefore chose to skip certain activities such as the notetaking part on day 1 for example and move straight into sketching activity.

Moreover, the team was a much smaller than that in the videos and certain adjustments required when distributing roles. The roles seemed to work well overall and each member of the team contributed well and with a general trust from other members of the team.

Besides, the team had to think on their feet for certain decision key to the design such as: Do we design for a smartphone or a PC? How do we design all the storyboards in a limited time? We generally managed to come up with a consensus for these key design considerations.

When we came to prioritising the screens to prototype on day 4, there was a little bit of a struggle and the team size created issues as it was difficult to get a clear majority with four individuals, one being the sketches originator. The voting process might have felt different and resulted in different priorities altogether, leading to more time spent elsewhere during the final prototyping. It is difficult to gage at this stage how this might have impacted the final prototype.

Other hurdles that sprung up were centred around specific design elements that we had not given much consideration to until it came to the actual prototyping. Below are examples of these that was noted during the process:

- What can be considered a useful timeslot for forecast predictions? More than 24hrs or even further? How often will a forecast be used?
- When is it needed to include back and forth buttons in pages and when should the navigation bar be hidden?
- How useful is the feature of forcing the appliances to start vs setting a flexible timeslot within which the machine should start?
- How do the users consider the semantics of captions and labels when choosing the program, for example the fact that 'program' is linked to an appliance and not the setup for a plug connection?
- How well do timeslot sliders work as selecting a timeslot?
- What is the most important part of the app; learning, education, using appliances, forecasting, consumption, comparisons or joining a community
- Which features can be successfully combined, such as setting up plugs, selecting appliances and setting up programs, or combining history and comparison?

In Appendix 2 – Picture gallery – we have shown illustration from all 4 days of our process.

## Evaluation

The evaluation day included 4 household users (3 male, 1 female) who visited our Sprint room individually. 1 hour was set aside per user and we followed the evaluation guide strictly (see appendix 1) (Knapp et al., 2016).

One from the team facilitated the evaluation and also controlled the prototype (primarily because of the covid-19 risks) and one from the team observed and took notes. The structure of the guide was divided into introduction of the project, introduction of the participants, presentation and walkthrough of the prototype, then tasks for the user to solve, then an overall evaluation and further questions. The content of the questions and tasks were derived from the previous list of questions.

## Key Learning Outcomes

Overall, the Sprint week turned out to be a great learning experience for the team. The team learned that it is possible to design a complete prototype and evaluate it in just FOUR DAYS!

We divide the key learning outcomes into two categories: process learning and product learning.

### Process learning outcomes

The team gained great insight in terms of ways to apply key design principles from leading industry experts in a diligent manner despite time constraints.

Key skills such as the ability to think fast in order to overcome potential hurdles were key to completing the process in a timely manner i.e. 4 days.

More than anything else, the team learnt that the key to the design Sprint week was to stick to the goal they set out at the beginning by coming back to the questions they had planned to answer by the end of the process. It is crucial throughout this process to have someone take notes of all the considerations and assumptions made as the day progress; the team found these notes to be paramount when putting together the interview guide for the final evaluation.

Moreover, the Sprint week gave the team an opportunity to grasp what an overall solution would be in a very short time; whilst giving the group a common understanding of the project goal.

Mutual respect about suggestions from different counterparts was paramount to the success of this week and the team thoroughly enjoyed the process. They will be looking to apply some of the skills and activities from the Sprint in future projects.

Finally, the team decided on the use of PowerPoint as a universal visual tool for our prototype design. The team found out that the quality of the design production did not matter as long as the visual aspect was clear.

### Product design learning outcomes

In the following table we divide the learning outcomes into general learning, description and implications. Implications here were issues of the design of the prototype that needed to be fixed for a later version after June 2020.

| ID | Learning outcome | Description or example | Implications |
|---|---|---|---|
| #1 | Impossible to create a walk-up-and-use application and the first time of | Despite showing the users the meaning | We require a fine process to determine |

| | | | |
|---|---|---|---|
| | usage will always be the hardest. | and walkthrough of the app, two users overlooked important links and were not willing to try further. Some of the features were so new (comparison and forecasts e.g.) | whether graphics and clickable links require assistance like encouragement based on which features the users use or a complete redesign as the application should be easy to use but also expand the user's horizon. |
| #2 | Interpretation of the semantics of icons will always differ and no important feature should rely on graphics only | Much controversy and interpretations differed of the initial bottom navigation icons. | Include text close to icons when they are central for navigation or functions. |
| #3 | Icons need to be made neutral based on the context | Tips and hints icon was a light bulb, and the users thought it mean power or lighting | Avoid icons and graphics that relate to the use context of the app (such as grids, power, appliances etc) |
| #4 | Avoid too many navigation areas | The bottom navigation bar included 6 icons which confused the users | Have a max of 4 icons/navigation areas |
| #5 | Difficult to prioritize the core functionality as a user due to a "schizophrenic app" | One of the users noted that the idea of learning, using appliances and saving power, and also viewing consumption history and comparing was too much for him | We made a choice to have only 4 core functionalities, and removing the other 2-3 to a "more" section. The primary core function of the app was decided to be "using appliances" as all other functionality depended on this. |
| #6 | Use standard selection of data or input | Inspired by an earlier report, we included a novel way to choose time durations as a slider, which was too ambiguous | Use calendar icons for time selection and the classic rolling time or pull down that takes screen focus. |
| #7 | Do not patronise users by having learning front and centre | Several of the users did not feel the need to see and learn about | Learning and tips will be more subtle and only occur as |

| | | | |
|---|---|---|---|
| | | energy as their primary action/opening page. | notifications over time. |
| #8 | Users with strong intrinsic motivation will not increase motivation by extrinsic motivation | One user noted that he had made the choice to install the app and so no amount of gamification, scoring, points or otherwise would increase his motivation. | Make sure that users can opt out of features so they do not create resistance towards unwanted features. |
| #9 | Users in the same household will have different motivation | One user noted that she was interested in the financial gains, while her husband was more interested in the green aspect | Tailor individually and not as a household. Make sure that household users are linked together. |
| #10 | The user is the front and centre to make sure that the logical model of the app corresponds to the physical model | The app has no way of knowing an appliance state unless the users define it in the app. The plug is limited in what it can gather of information. | A large degree of manual process will need to be visualised to the user to teach how to use the app. App and appliance should never be used alternatingly but sequentially |
| #11 | Users were still a little in doubt of how the process worked | The users assumed that the app worked. | More testing on an individual level need to be done, e.g. with a prop appliance. |
| #12 | Some users will be unable to use the plug because their appliance cords are implemented into an internal wall outlet | One user explained that his electricity for appliances was hardwired into the wall | Make sure that users that opt in test out their appliances first prior to enrolling them. |

## Appendix 1 – Interview Guide for final day usability testing

1. Intro:

- We are testing this system to monitor and help households use more Green energy
- Please tell us all your thoughts and questions so we can improve the system – note that the negative things you say to us are even more valuable than the positives you will say.
- We are testing the design, trying to see it through fresh eyes, we are not testing you.

2. Context

Context questions...(tell us about yourself, what you do etc) background – 10 mins of conversations

3. Prototype

[Bring up the prototype on big screen]

- Be aware that some things might work, some might not, we are not testing you.
- How would you navigate around our system?

4. Usability test

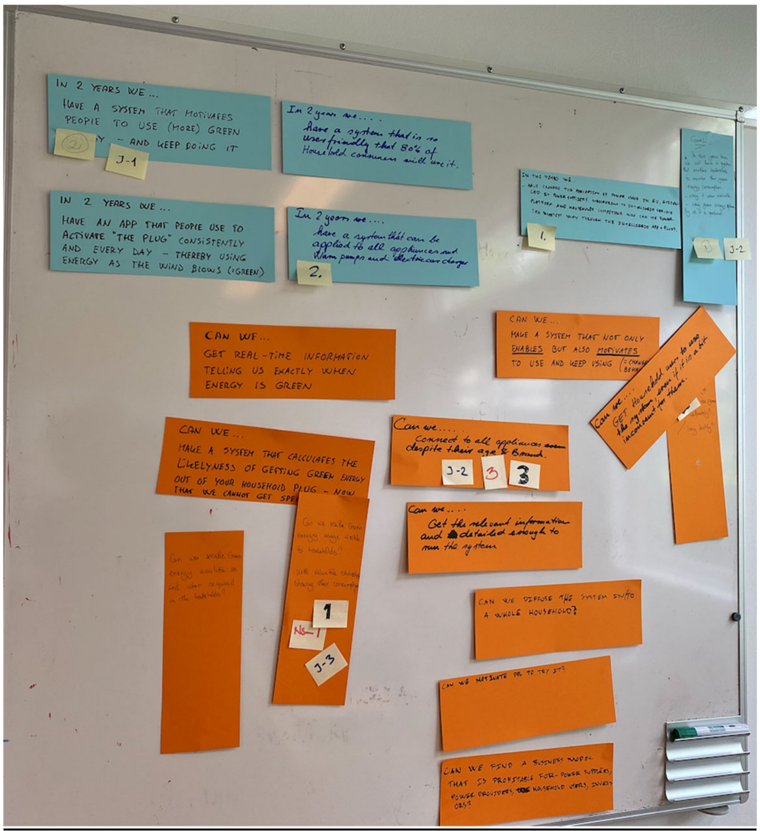
1. Assume you have installed a plug no. 1 on your washer. You would like to start a program so it is ready by 8am tomorrow
2. You are now installing a dishwasher. You are regularly using three programs called dirty, eco and quick. Set up the system so these three programs are in your profile
3. Start the dishwasher using the quick program so it is ready by 6pm
4. You just came home with your electric car. You know you need it soon again and would like to force the plug to charge the car NOW
5. You would like to see how you are doing. How much money have you saved? How much $CO_2$ ?
6. Are you better or worse than the average. Take a look
7. Try to find tips for how you can improve?

5. Debrief and exit

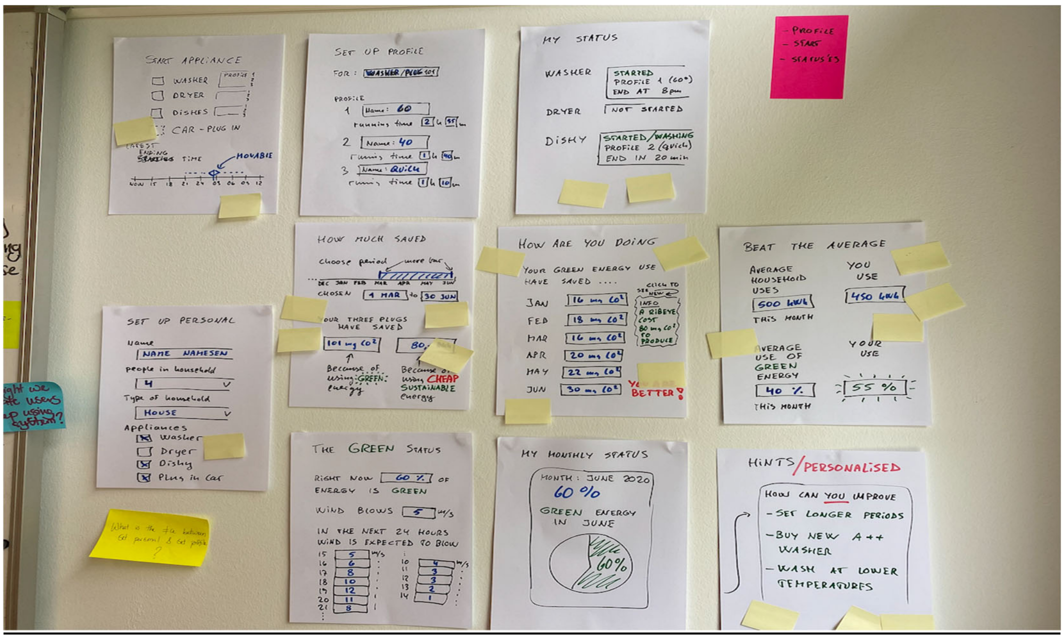
- So far as we have gone through it, what do you think of this?
- Was it explained well enough how the system contributes to a greener World? - and does that motivate you to use the system?
- What motivates you <u>the most</u> to use the system; the green aspect, the comparison to others or saving money?
- Have we produced a system that calculates the likeliness of green energy availability in a way <u>useful for you</u>?
- Do you feel that most of <u>your</u> appliances could connect to the system

## Appendix 2 – Picture Gallery

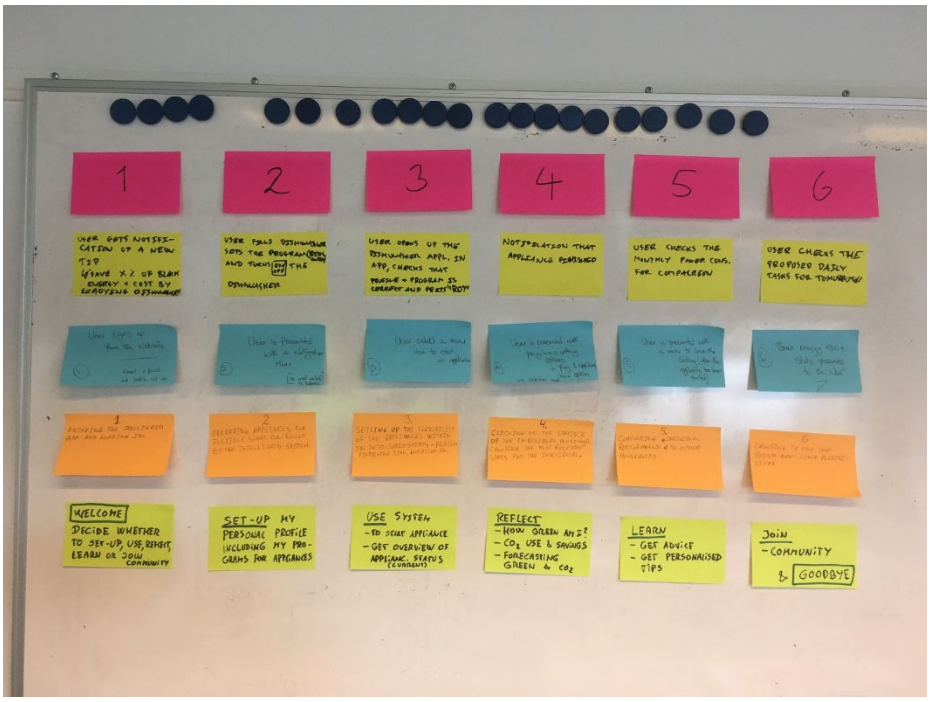
Some images captured during the course of the week -including some of the final prototype.



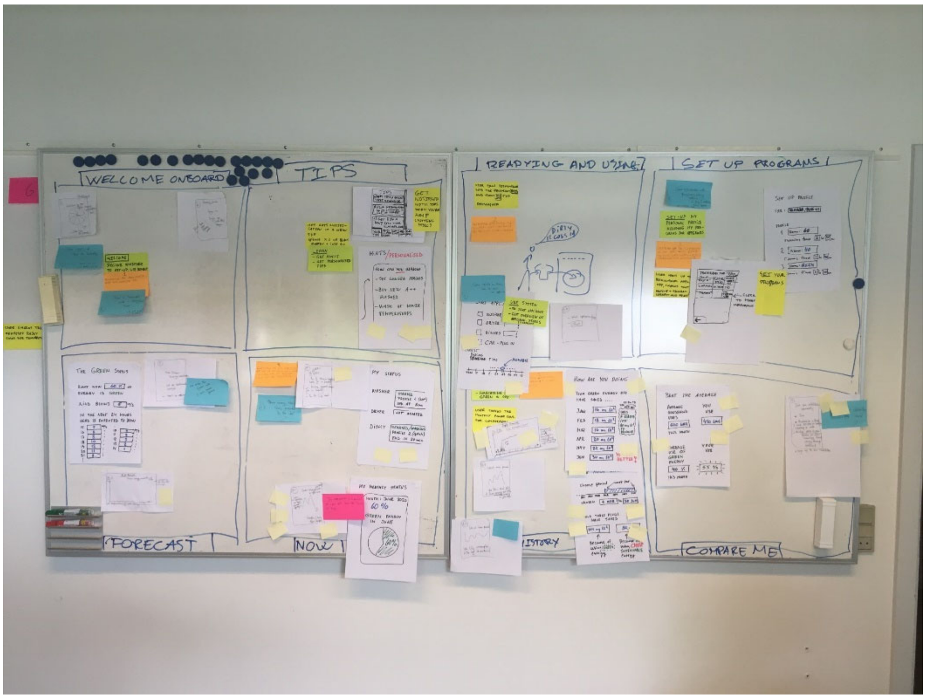

Day 1: Brainstorming key questions to answer



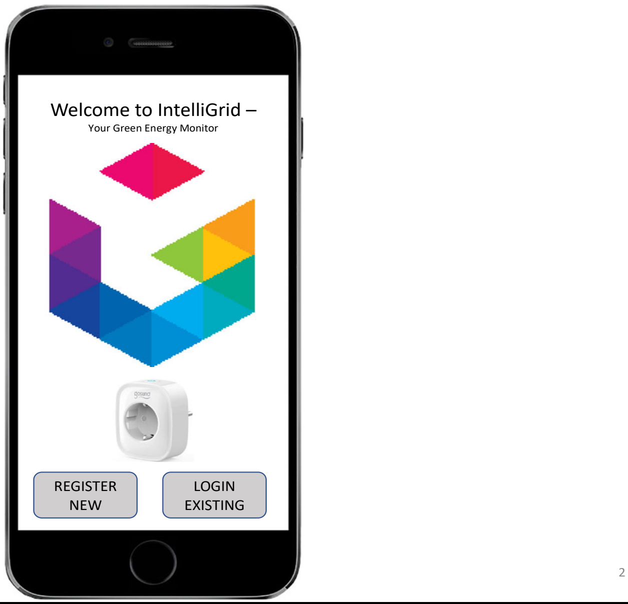

Day 2: Alternative ideas with votes (post-it notes) from all team members



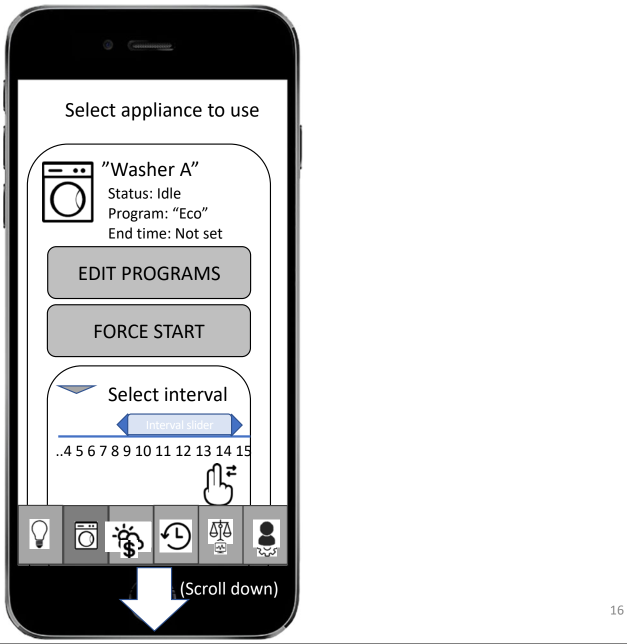
Day 2: The user experience in six steps as recommended by AJ Smart (Smart, 2020)



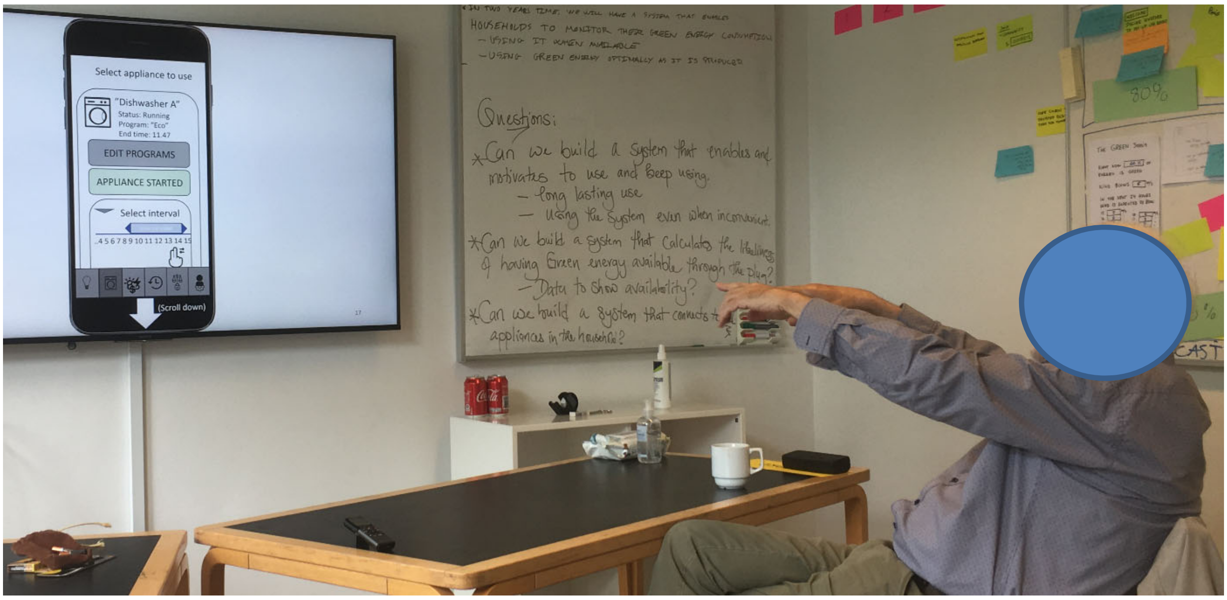
Day 3: The storyboard for the prototype




Day 3: The prototype login screen




Day 3: Screen from prototype. Here user can set up an interval for starting an appliance




Final day: User testing the prototype

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