Optimising operational energy performance through Augmented Intelligence Dashboards *End-User Experience*

June 2023 | IES R&D

SUSTAINABLE PLACES 2023

This project has received funding from the European Union's Horizon 2020 Programme under Grant Agreement no 101000169

Agenda

- Introduction
- Goals
- Our process
- Prototype
- Next Steps
- Q&A

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Introduction

The goal of the EU Strategic Technology Plan is to improve the energy efficiency and sustainability of buildings.

To develop an interoperable and user friendly system to support the end-users in their daily life energy usage by using Augmented Intelligence solutions to enable buildings and their users to be come self-optimising.

Introduction

"Auto-DAN will provide real-time suggestions to buildings' occupants to improve their operational energy consumption, while expanding the update of demand response actions in residential and small-to-medium size commercial buildings across the EU."

Goals

- Understand our end users
- Create a solution to encourage users to adopt operational change to improve building energy performance
- Test and optimise the solution to fit the needs of our end-users

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Our process

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Strategic Alignment

- Align all stakeholders on the scope of the work package
- Who we're solving for, what are the main challenges we're trying to overcome,
- Why it's important to overcome, and how will we know that we were successful?
- Create a problem statement, goal definition and proto-personas

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Problem Statement

- *Building owners and persons responsible for managing energy efficiency currently do not view the connection between energy price and consumption. Additionally, they find it difficult to understand how their behaviour contributes to energy consumption and cost. Currently, no way exists for users to view which actions they can take to reduce energy costs and consumption. An inability to view the subsequent best actions also extends to comfort level decisions.*

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Goal Definition

- *"Develop an innovative Augmented Intelligence dashboard system that non-technical building users can use to visualize the trends in their energy consumption in an intuitive and easy to use way, provide feedback and recommendations on how to improve their energy consumption/cost while being sustainable and environmentally conscious. In addition, where relevant, we want to execute both through automated control and user feedback, demand-response actions, and other energy efficiency measures in their buildings. The tool should consider the direct impact of current behaviour and the impact of behavioural change in terms of energy cost and consumption and the environmental cost of such measures. We would aim to have users engage with the tool at least once per day, implementing at least one action per interaction (?) with the intent of achieving the energy consumption cost targets identified in the grant agreement over one-year post-implementation."*

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Goal Definition

- *Develop an innovative Augmented Intelligence dashboard system that non-technical building users can use to visualise the trends in their energy consumption*
- *Visualise the trends in users energy consumption*
- *Provide feedback and recommendations on how to improve their energy consumption/cost*
- *Execute both through automated control and user feedback, demand-response actions*
- *Achieve the energy consumption cost targets identified in the grant agreement over one-year post-implementation*

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Research & Analysis

- User Interviews
- Desk Research
- Analise data to identify themes and relationships between these themes
- Data and insights gathered during this process serves as input into the review of our initial understanding of the problem and actors

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Research &Analysis – Key Takeaways

Decisions are financially Motivated

Although there is an awareness of the environmental impact, the main reason for reducing energy consumption is to save money. Being able to see ROI on effort was cited as necessary.

Lack of detailed, live data undermines efforts

Not being able to track consumption at the appliance level in real-time disengages people from energy savings efforts

Limited knowledge of energy savings practises

None of the participants rated themselves as knowledgeable on the topic, nor could they identify resources they would access to gain knowledge.

Comfort and convenience dictate behaviors

Participants are unlikely to act on recommendations if it negatively impacts their comfort or convenience.

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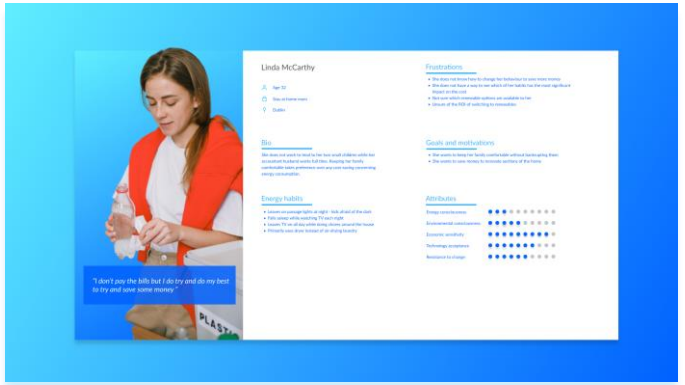
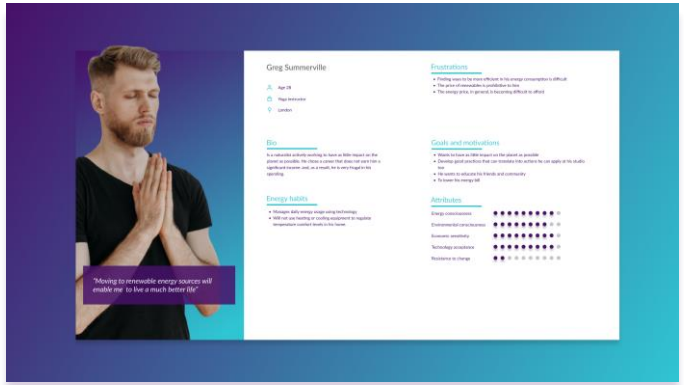
Proto Personas





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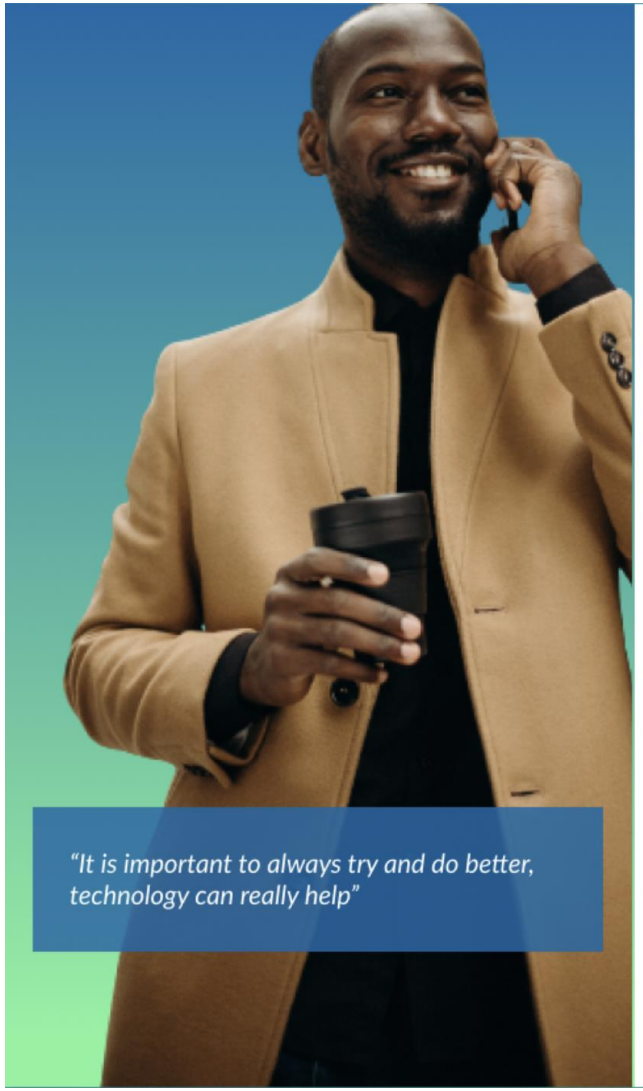


Daniel Kovács

- Age 41
- Apartment Block Owner
- Budapest

Bio

He owns a residential apartment building. It is his long term goal to acquire another building. He sees this as his legacy for his children and to support his family in the future.

Energy habits

- He actively monitors energy consumption and associated costs closely daily
- He creates and manages maintenance schedules of all building equipment diligently

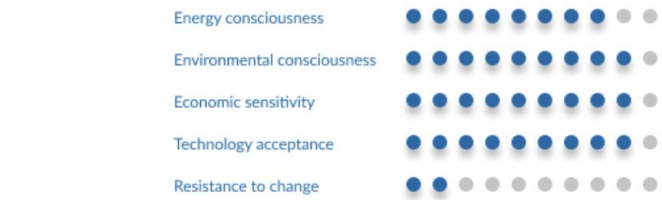
Frustrations

- He has to handle energy challenges reactively
- He does not know what he can do to improve efficiency apart from ensuring the equipment is maintained and in good running order
- Unsure of what to invest in to make the building more appealing for tenants
- The legislation prohibits building owners from making changes or upgrades as they see fit for their environment and circumstances
- Dealing with occupant complaints

Goals and motivations

- Save as much money as possible while keeping his tenants as comfortable as possible
- Be able to maintain equipment proactively
- Want to increase his profit margins and make his buildings more attractive to potential tenants
- He would like to attain some "Green Accreditation"
- Have a view of the latest trends to advise tenants accordingly
- Better data for better-informed decision making

Attributes



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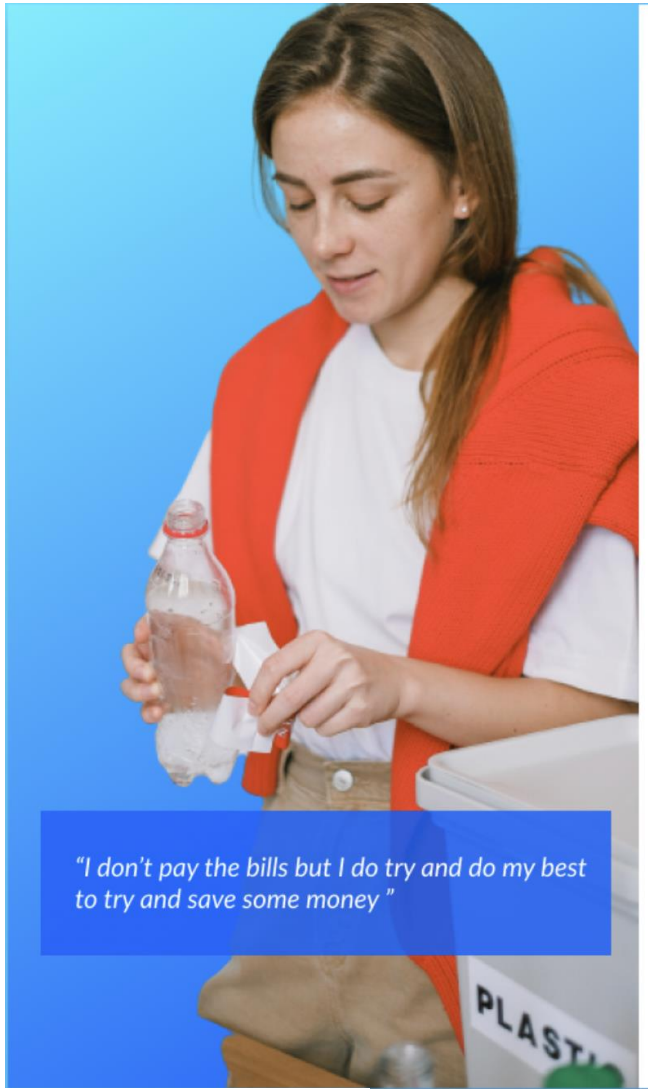

Linda McCarthy

- Age 32
- Stay at home mom
- Dublin

Bio

She does not work to tend to her two small children while her accountant husband works full time. Keeping her family comfortable takes preference over any cost-saving concerning energy consumption.

Energy habits

- Leaves on passage lights at night - kids afraid of the dark
- Falls asleep while watching TV each night
- Leaves TV on all day while doing chores around the house
- Primarily uses dryer instead of air-drying laundry

Frustrations

- She does not know how to change her behaviour to save more money
- She does not have a way to see which of her habits has the most significant impact on the cost
- Not sure which renewable options are available to her
- Unsure of the ROI of switching to renewables

Goals and motivations

- She wants to keep her family comfortable without bankrupting them
- She wants to save money to renovate sections of the home

Attributes

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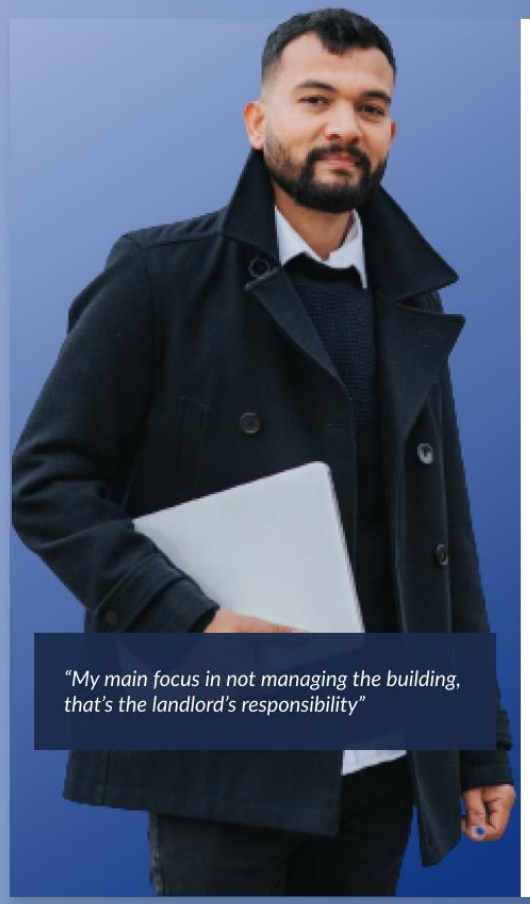

Dave Simmonds

Age 46

Small Business Owner

Limerick

Bio

He is the owner of a small engineering company. He rents space in a small warehouse that serves as both office and workshop space. Apart from business responsibilities, he also performs the function of the building manager, which includes energy management.

Energy habits

- Switches on all inside lighting when arriving in the morning
- Has water heater on all the time to keep water ready for tea and coffee for everyone at the office
- Switches on heating to heat the office before rest of the staff arrive
- He leaves all external lighting on when he leaves for security reasons
- Prioritise internal activity over energy considerations
- Applies default (legislative) values to the building portfolio

Frustrations

- The lack of data to set thresholds for individual building
- Inability to compare areas or zones in a building
- Has no way to tell which bits of equipment are not performing as they should
- Not sure he can trust data
- Dealing with occupant complaints
- How complaints are recorded and communicated
- "Justify "the energy management (e.g. regulation) of the building to the building owner
- Cannot distinguish building loads from activities carried out, e.g. manufacturing

Goals and motivations

- Improve the energy efficiency of the company to save them money
- Use green credentials in a commercial context
- Be able to maintain equipment proactively
- He wants his boss to notice that he actively tries to contribute to the company's profit margin
- Reminders that equipment is set to manual mode when it can be automated
- Have an instrument to inform the communication with the building owner and building occupants
- Simulate intervention strategies
- Have data enough to communicate with occupants efficiently

Attributes

Energy consciousness

Environmental consciousness

Economic sensitivity

Technology acceptance

Resistance to change

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How might we statements

The **HMW format** helps us define our biggest challenge without prescribing a solution.

- '**How**' assumes that there are solutions out there, so it provides confidence.
- **'Might'** suggests that the group can put ideas out there that might work or might not - either way it is ok.
- **'We'** suggests the group is going to do it together and build on each other's ideas.

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How might we statements

- How might we give users the ability to measure and track their consumption and savings in real-time?
- How might we inform users of the financial gains they can achieve by reducing energy consumption?
- How might we make it easier for users to set realistic savings targets?
- How might we communicate their current behaviour's impact on the environment?
- How might we educate users on ways to save on energy consumption?
- How might we ensure that proposed solutions are cheap and easy to implement?

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Design

- Design workshop
- Remote
- Miro

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Online design sprint

- Encourages collaboration through making.
- Brings together varying stakeholders to work towards a shared vision
- Reduces the cost of failure
- Encourage original thinking through experimentation
- Makes it possible to explore ideas that would typically be rejected by the company out of hand
- Obtain real data from real users using a realistic prototype - fast forward into the future

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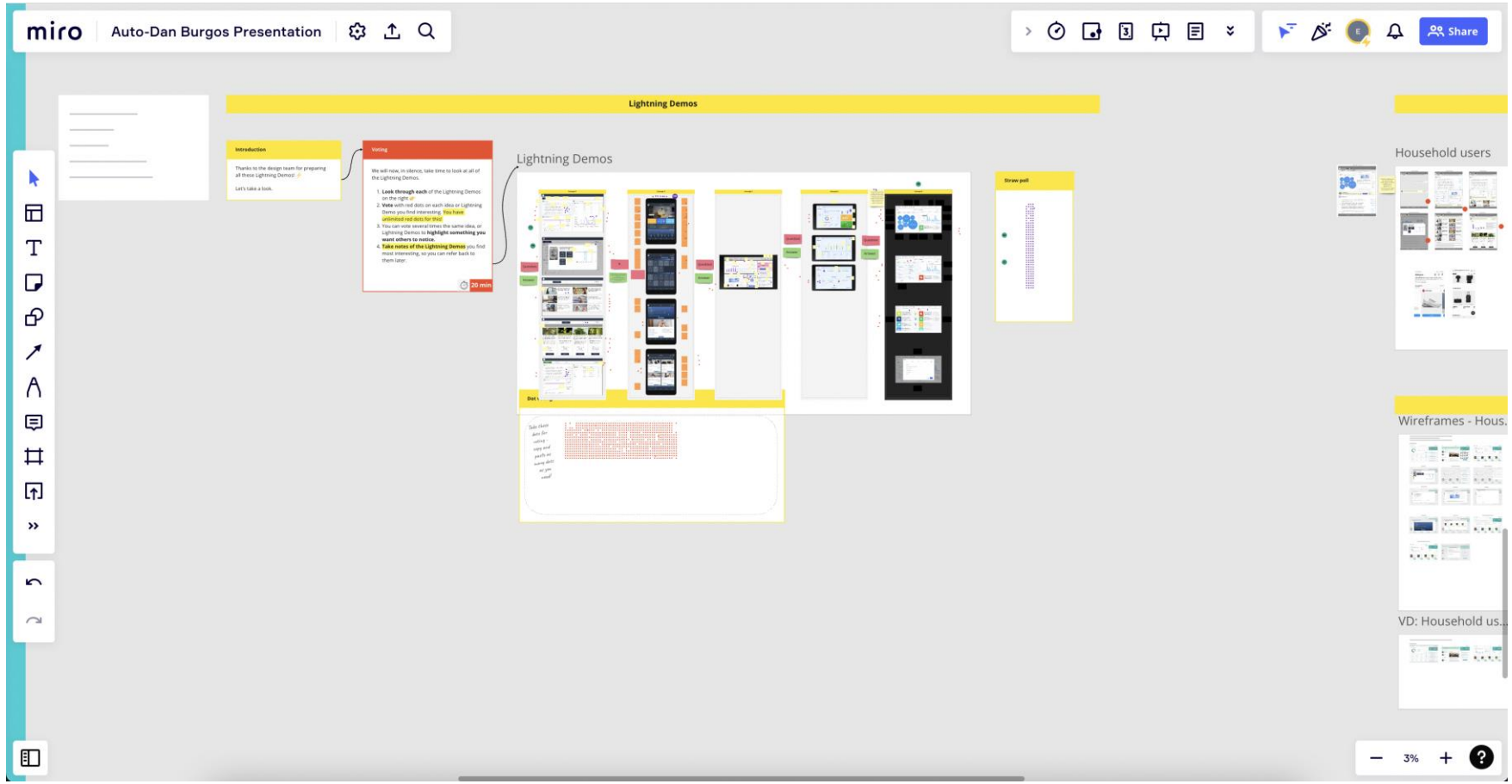
Online design sprint



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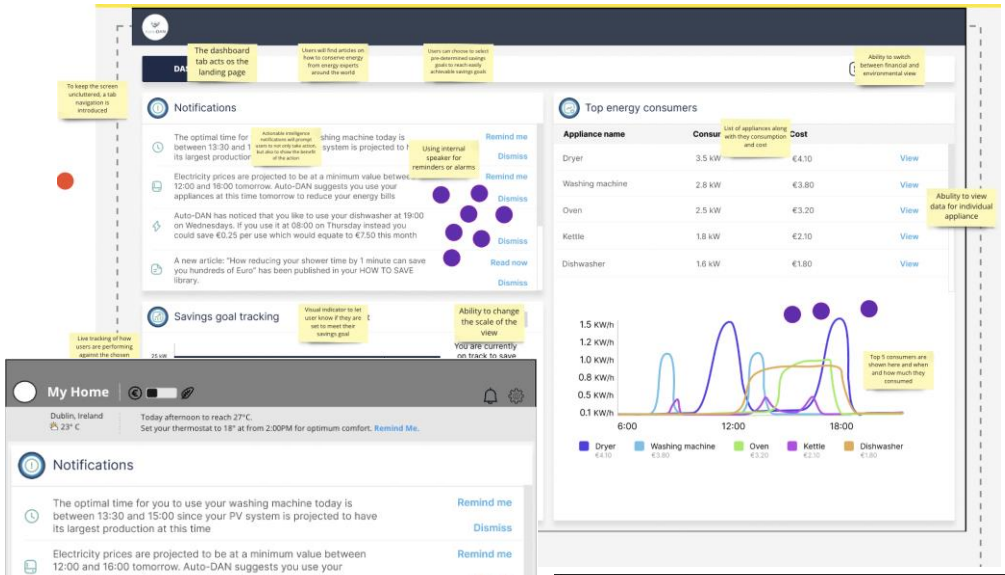
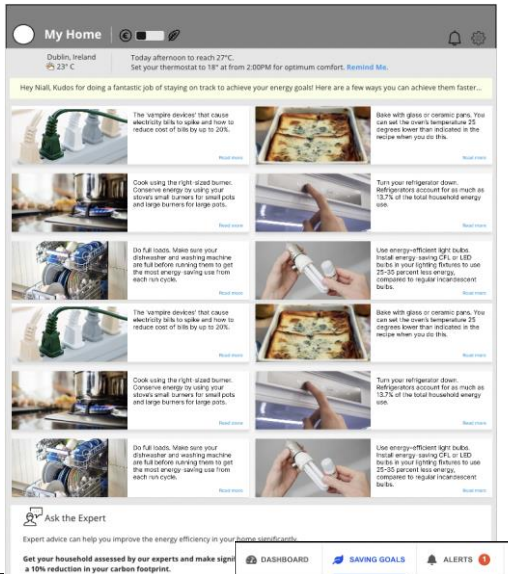
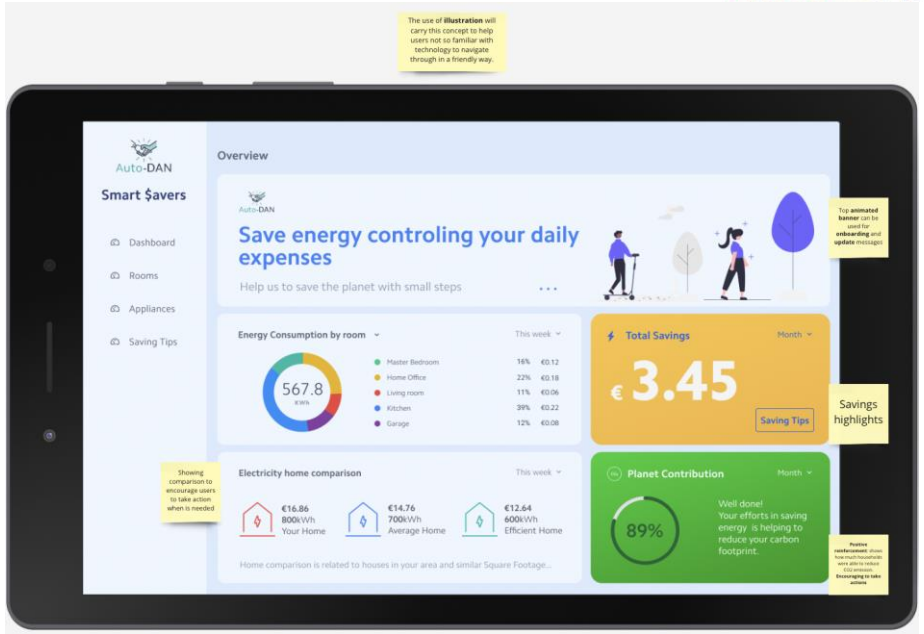
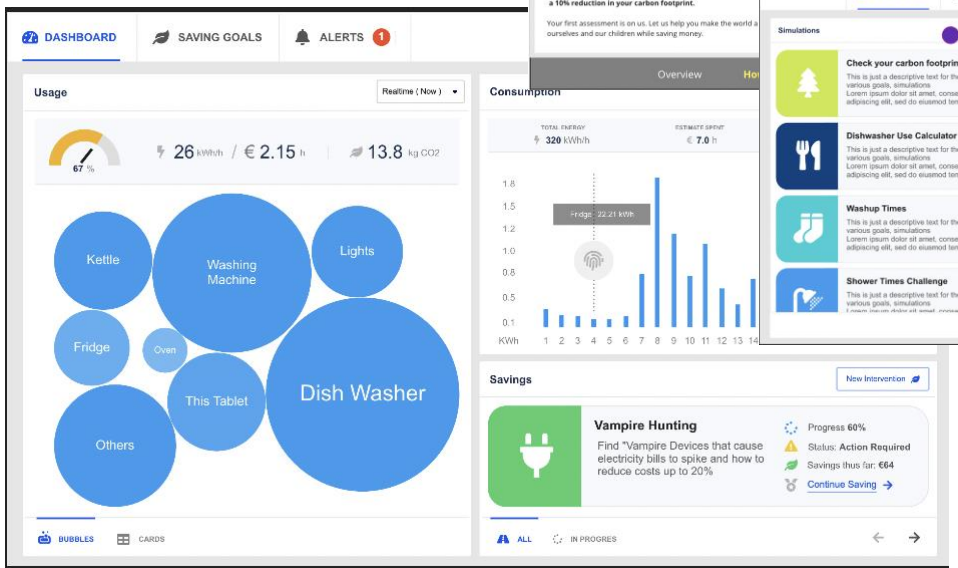
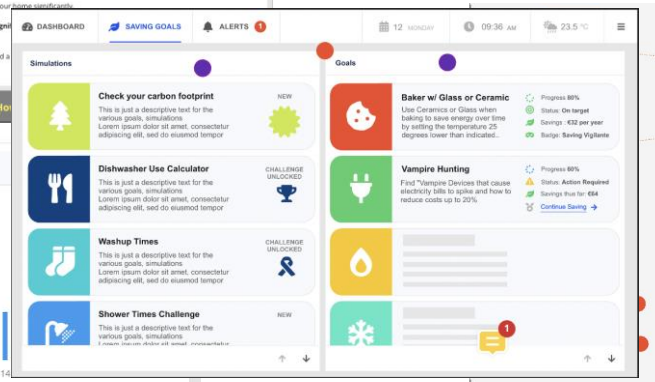
Concepts

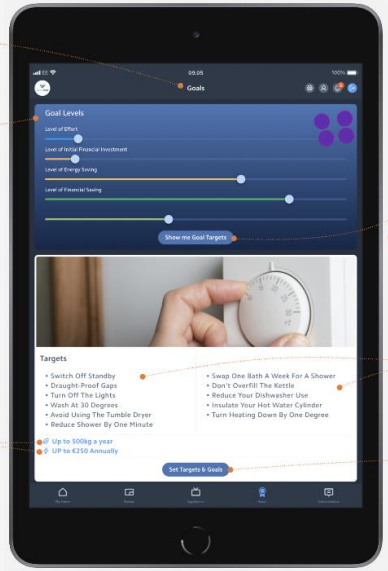

Notifications
Top energy consumers
Savings goal tracking
My Home
Notifications
The optimal time for you to use your washing machine today is between 13:30 and 15:00 since your PV system is projected to have its largest production at this time
Remind me
Dismiss
Electricity prices are projected to be at a minimum value between 12:00 and 16:00 tomorrow. Auto-DAN suggests you use your appliances at this time tomorrow to reduce your energy bills
Auto-DAN has noticed that you like to use your dishwasher at 19:00 on Wednesdays. If you use it at 08:00 on Thursday instead you could save €0.25 per use which would equate to €7.50 this month
A new article: "How reducing your shower time by 1 minute can save you hundreds of Euro" has been published in your HOW TO SAVE library.
Read now
Congratulations!
You saved €8 on gas this month and won the Tree badge!
Set New Goal
Overview
How To Save
Goals


My Home
Ask the Expert
Overview

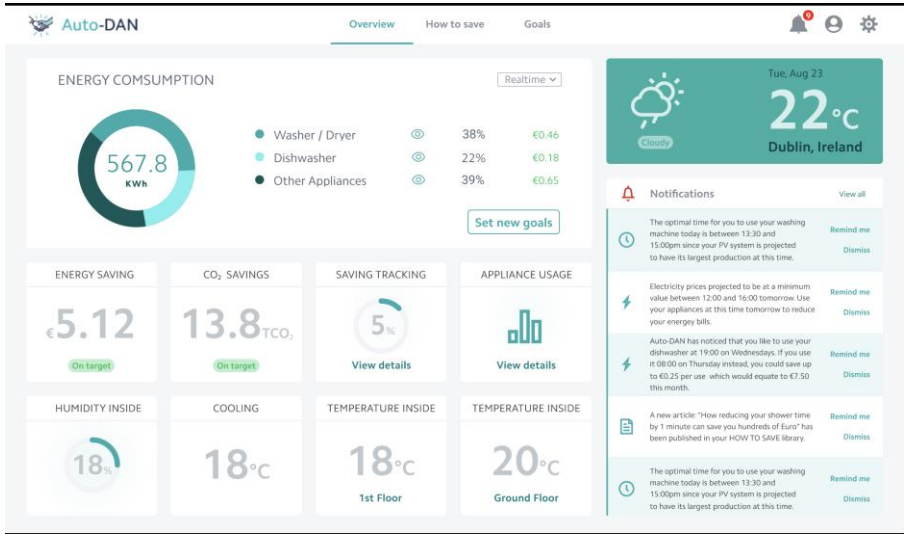

Auto-DAN
Smart $avers
Dashboard
Rooms
Appliances
Saving Tips
Overview
Save energy controling your daily expenses
Help us to save the planet with small steps
Energy Consumption by room
567.8
Total Savings
€ 3.45
Saving Tips
Savings highlights
Electricity home comparison
€16.86
800kWh
Your Home
€14.76
700kWh
Average Home
€12.64
600kWh
Efficient Home
Planet Contribution
89%
Well done!
Your efforts in saving energy is helping to reduce your carbon footprint.

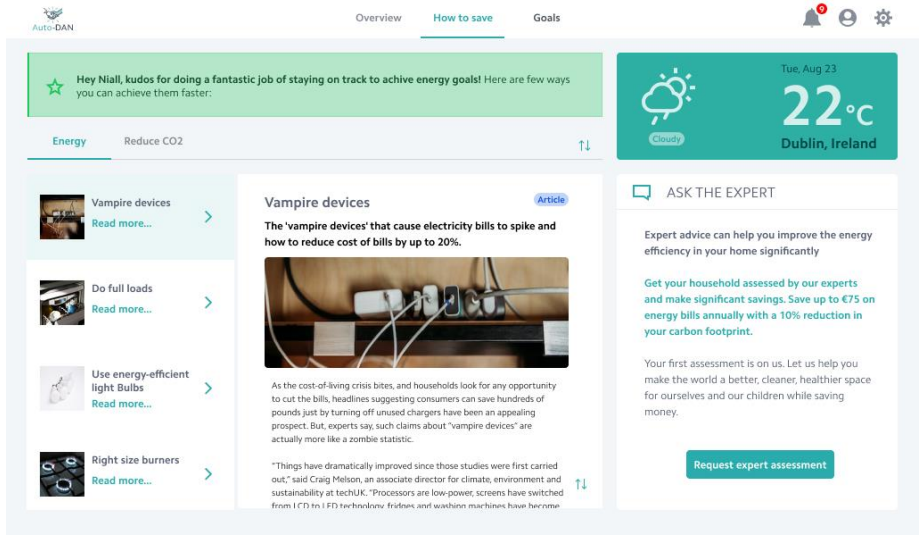

DASHBOARD
SAVING GOALS
ALERTS
Usage
26 kWh/h
€ 2.15
13.8 kg CO2
Kettle
Washing Machine
Lights
Fridge
Oven
This Tablet
Dish Washer
Others
Consumption
Savings
Vampire Hunting
Find "Vampire Devices that cause electricity bills to spike and how to reduce costs up to 20%
Progress 60%
Status: Action Required
Savings thus far: €64
Continue Saving

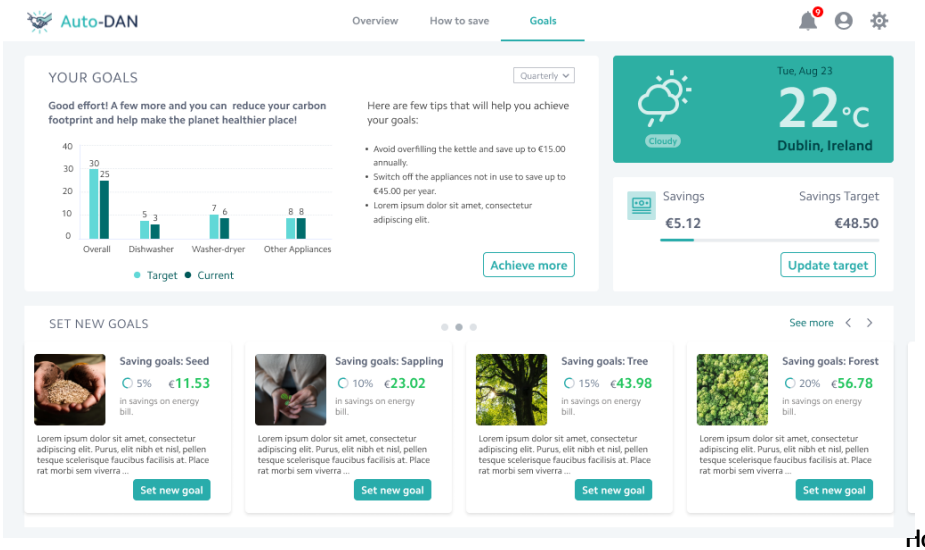

DASHBOARD
SAVING GOALS
ALERTS
Simulations
Check your carbon footprint
Dishwasher Use Calculator
Washup Times
Shower Times Challenge
Goals
Baker w/ Glass or Ceramic
Vampire Hunting


Goals
Goal Levels
Show me Goal Targets
Targets
Set Targets & Goals

Final Concepts







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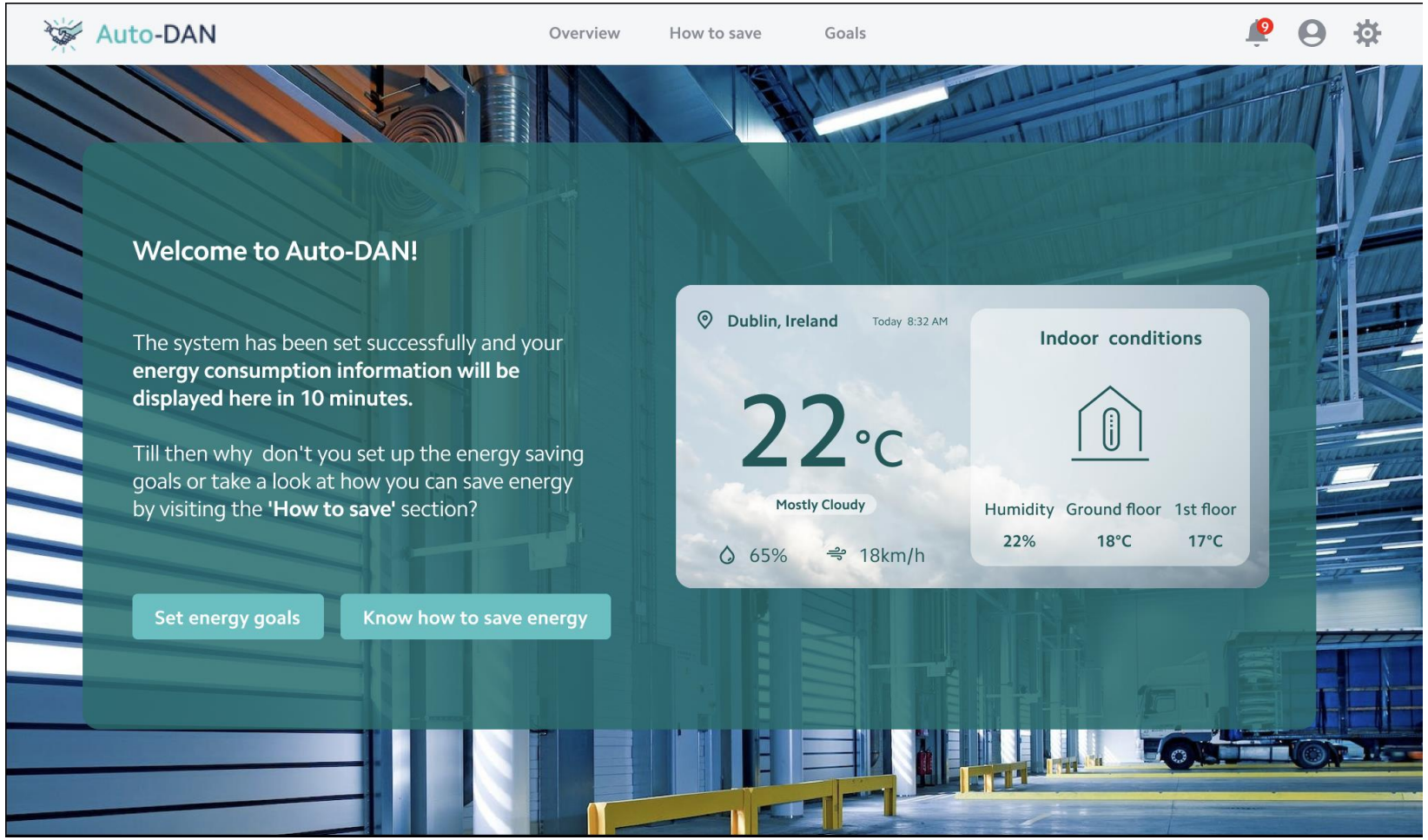
Prototype



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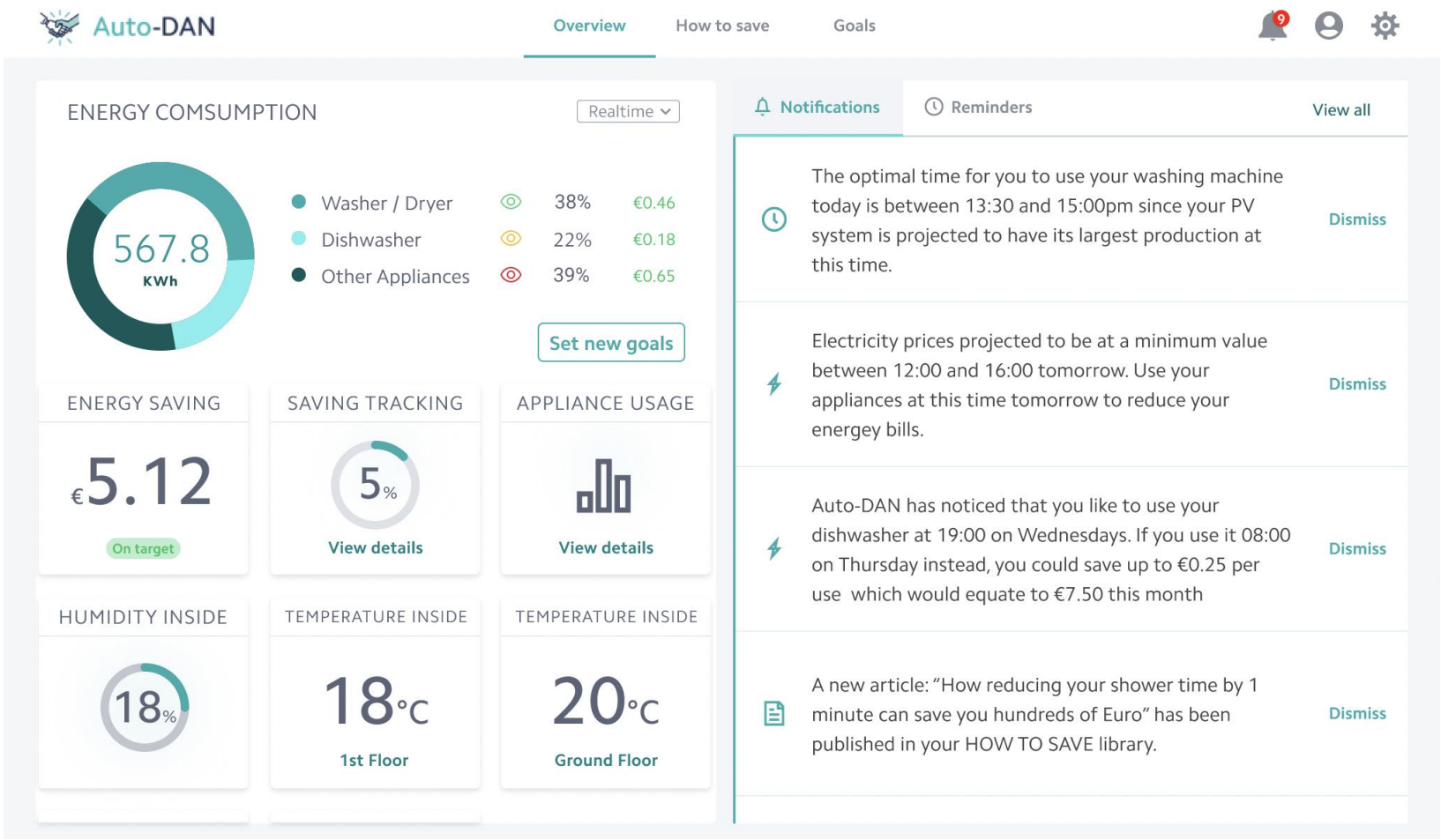

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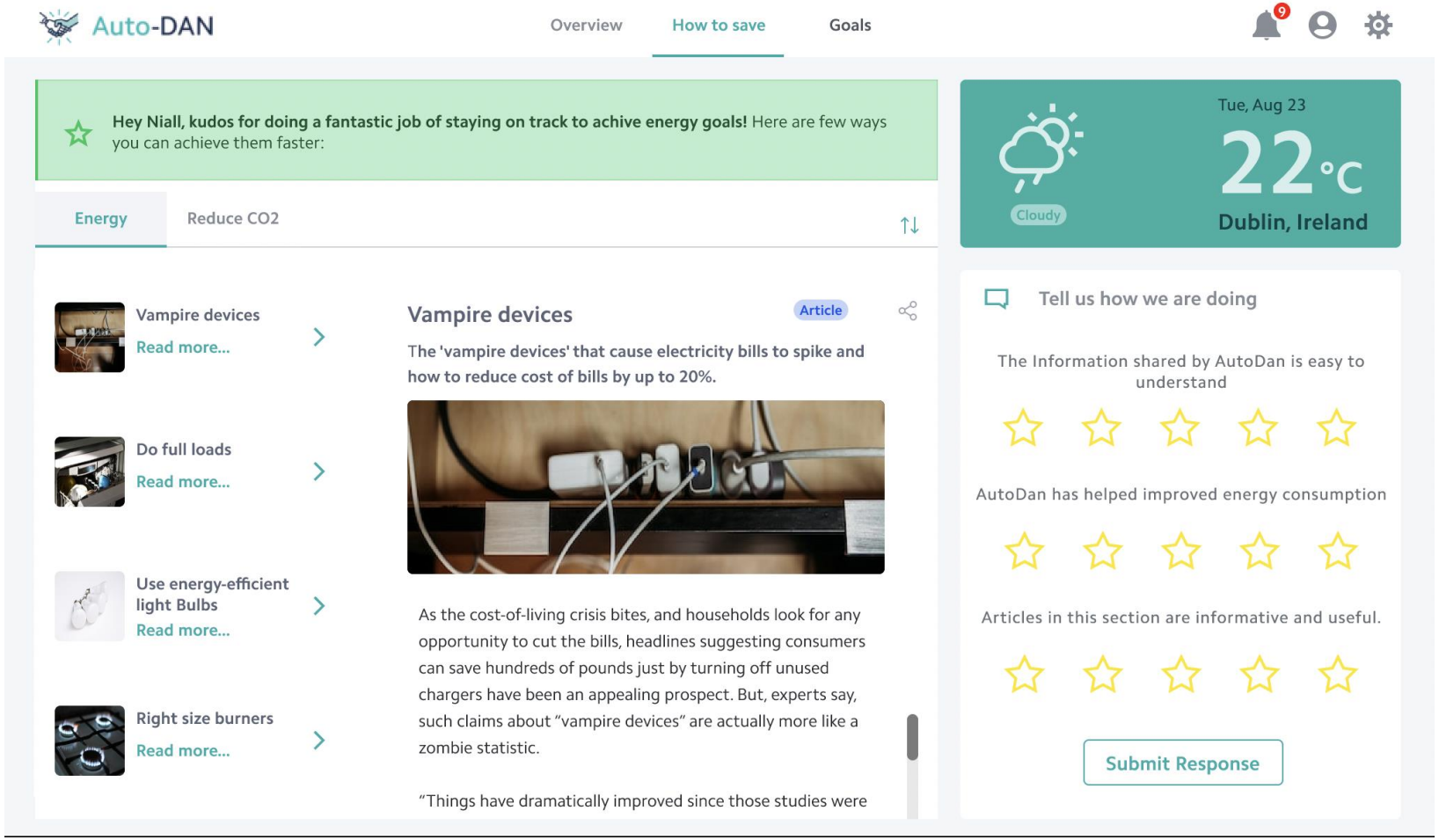

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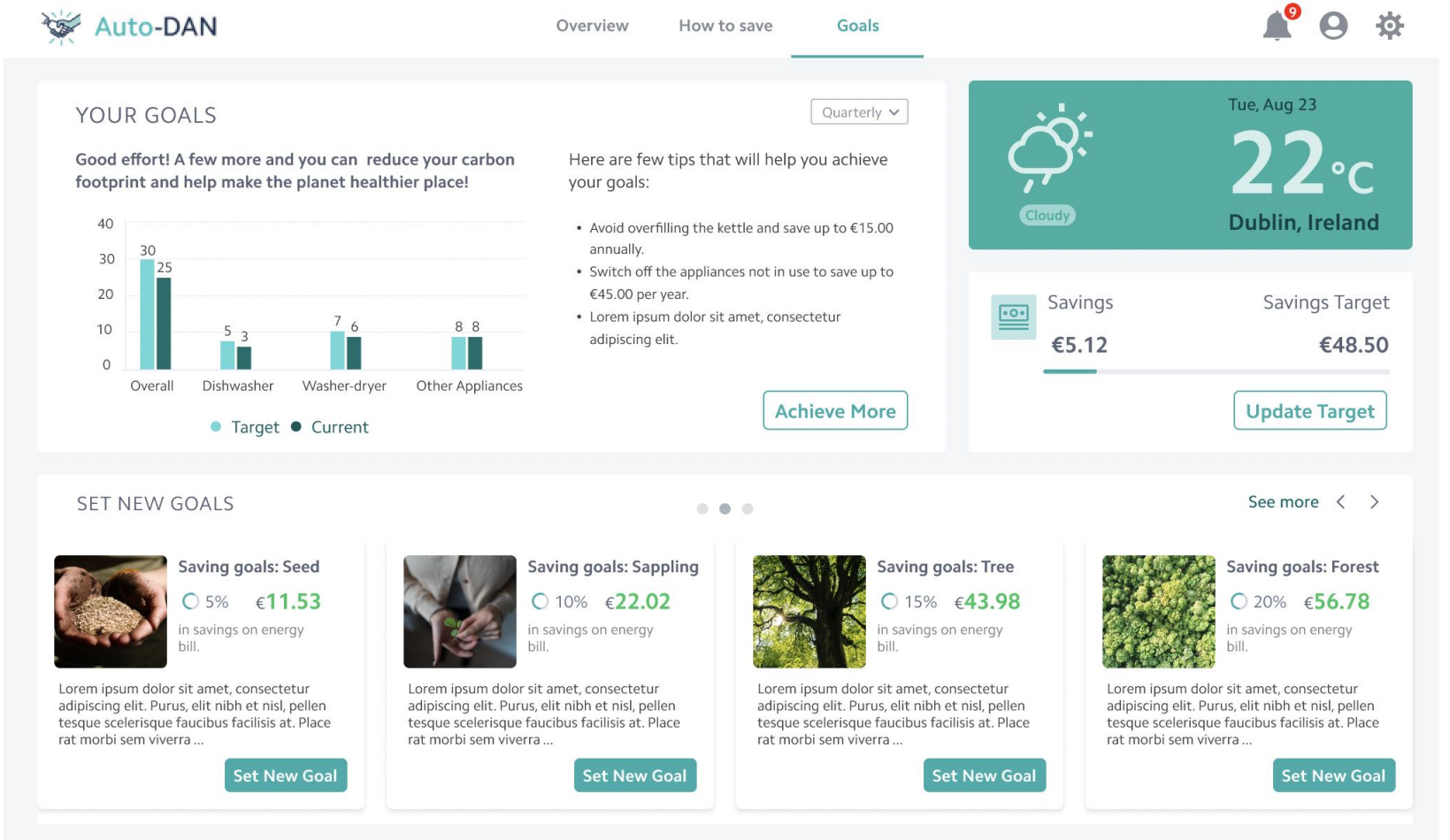

[Link to prototype]

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Next Steps

- User testing
- Iterate designs based off user feedback
- Prototype again and validate design decisions
- Develop and measure

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Thank you!

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