BACHELOR THESIS

DESIGNING AN INTERACTIVE TRAVEL CHECK TO INCREASE SUSTAINABLE TRAVEL

JOSHUA VAN DER MEER

BSC CREATIVE TECHNOLOGY / FACULTY OF EEMCS

DR. J. ZWIERS / SUPERVISOR
DR. C.M. EPA RANASINGHE / CRITICAL OBSERVER
B. MARECHAL / CLIENT

UNIVERSITY OF TWENTE

4 JULY 2021

UNIVERSITY OF TWENTE.

Page intentionally left blank

Abstract

The University of Twente (UT) strives to be CO2 neutral by 2030. One of the areas in which improvement can be made, is mobility. Mobility refers to commuting and business travel together, which contributed to 31% of the CO2 footprint of the UT in 2019. This research aims to help reduce the CO2 emission in the area of mobility by designing and creating an interactive travel check: A tool that assists UT staff in selecting a travel mode, while focusing on and nudging towards sustainable modes of travel. Most importantly, the goal of this research is to find out how such a travel check should be designed in order to effectively contribute to an increase in sustainable travel.

After performing a literature review and examining similar implementations in a state of the art review, the first steps were taken in designing the UT travel check. Through ideation and specification, finally a prototype was created that could be tested with the target group: staff and secretaries at the UT. The results of the evaluation showed that although there was a lot of positivity around the prototype, some crucial improvements need to be made to the travel check in order to make an impact. Especially the reusability of a travel check seems to be of great importance to achieve the desired result of increasing sustainable travel.

Both integrating the travel check in the booking process and integrating existing travel planners could contribute to an effective travel check. The realized prototype could serve as a great starting point for future implementation of a travel check.

Page intentionally left blank

Acknowledgement

First of all, I would like to thank my supervisors dr. Job Zwiers and dr. Champika Ranasinghe for their support and feedback in my graduation project.

Secondly, I am very grateful to Brechje Marechal for giving me the opportunity to work within the topic of sustainability. On top of that, her feedback and support have always been really motivating and her support in distributing the user test has massively contributed to a proper and successful evaluation of the final product.

I want to thank all the people who participated in the user test or have provided me with feedback in any other way.

Finally, I would like to thank my girlfriend, Eva Lahuis, for supporting me and inspiring me throughout the graduation process.

Page intentionally left blank

Table of Contents

Page intentionally left blank

List of Figures

Page intentionally left blank

1. Introduction

Sustainability is perhaps one of the most prominent topics on the political, economical and societal agenda nowadays. Given their pioneering role in society, the University of Twente (UT) can not abstain from making a sustainability policy and implementing measures to increase sustainability. Therefore, in January 2020 the UT adopted a new strategy, Shaping 2030, which includes the strategic ambition of having become a sustainable organization in 2030: The UT strives to be CO2 neutral by 2030 and realize a 15% reduction of CO2 emissions by 2023 (compared to 2020) [1].

One of the areas in which the UT wants to improve on sustainability is that of mobility, which has a substantial impact on their CO2 footprint. Commuting and business travel together contribute around 10.000 tons CO2, around 31% of the entire UT CO2 footprint [2]. In order to achieve the target of a 15% reduction by 2023, the UT has to develop guidelines and implement measures for both employees and students. These guidelines consists of using the bike for distances up to 15 kilometers, using digital technologies for conferencing, and when travel is unavoidable, using the train for work trips with a distance smaller than 800 kilometers [2].

One of the measures the UT wants to implement to support these guidelines is that of an interactive travel check, which assists employees and students in making the choice that is most sustainable, taking their situation into account. Other universities have already implemented such travel checks, one of which is currently referred to by the UT: the Utrecht University travel check [3].

Of course, the UT wants to have a travel check of their own. The existing travel check implementations provide the UT with the opportunity to identify strengths and weaknesses, in order to create the most effective version of a travel check yet. The project is commissioned by Brechje Marechal, who is an Environment & Sustainability Policy Officer.

In this project, the goal is to research how a travel check should be designed, ultimately resulting in a prototype that can be tested and evaluated. The main research question that drives this research is:

How should a travel check be designed to increase sustainable travel at the UT?

There are several aspects to this research question that need to be taken into account. These aspects are addressed by the following sub questions:

1. How can the usage of sustainable travel modes be incentivized?
2. What kind of information should be included in a travel check?
3. What should a travel check have to offer to make users return?

The first question aims to find out what measures can be used to steer users towards the sustainable modes of travel. The second sub question is meant to find out the different types of information that could be provided in the travel check, such as travel information to a certain destination, but also general information about discounts, where camera equipment can be found and so on. Finally, in the third question the goal is to find out how users can be motivated to use the travel check every time they travel, consequently being forced to make a conscious decision while simultaneously being influenced by the incentivization measures found in sub question 2. These three questions together answer the main question and describe how the UT travel check should be designed.

In this report, the process of researching and developing the travel check application is described. The background research in chapter 2 describes and evaluates similar existing implementations, but also addresses literature's recommendations with regards to sustainability measures and incentivization. In the ideation phase (chapter 3), the first ideas and requirements for the UT travel check are generated, leading to the specification in chapter 4. Subsequently, the realization of the travel check is described in chapter 5, explaining what functionalities and features have been included and how these are programmed and designed. The final prototype is evaluated in chapter 6, using a functional test, a user

test and a final evaluation with the client. Finally, the research questions are answered in chapter 7 and future recommendations are made in chapter 8.

2. Background Research

The background research consists of a literature review, state of the art research and an expert interview. It provides an insight into the context of the project and highlights the several aspects of a travel check application.

2.1 Literature Review

2.1.1 Introduction
To achieve the goals of reducing the CO2 footprint, the UT wants to develop an interactive travel check that incentivizes users to using sustainable travel modes. In order to create this travel check, it is important to find out how people can be incentivized to choose a sustainable mode of travel. Therefore, the main goal of this section is to give insight into the question *how universities can incentivize people to choosing sustainable modes of travel.*

2.1.2 Recommended Measures and Incentives
Literature mentions several measures to incentivize sustainable travel for universities. The measure with the largest support of literature is an (increased) parking fee [4, 5, 6, 7], although this is invalidated by Sargisson [7], who performed an experiment in which parking fees were introduced and the resulting traffic monitored. The conclusion from this experiment was that the amount of traffic by car was not reduced when increasing the parking fees. However, the suggestion was made that, in order to have an impact, the parking fee should be increased to a value at which the costs of parking at least outweigh the costs of alternative travel modes. Furthermore, the amount of parking spots should be reduced and car-poolers should be given advantages in the form of parking discounts [4]. Universities should initiate car-pooling through a central database [4]. Instead of offering parking subscriptions, the threshold of parking should be increased by compelling users to buy a parking ticket each separate time [7]. The travel check application could focus on initiating carpooling by setting up or linking to a carpooling platform.

There is also a lot of growth potential for active travel. Safe parking facilities for bikes [6, 7, 9], shower facilities [9] and bike 'libraries' [6, 10] are mentioned to increase bicycle usage. E-bike rental and sharing [4, 12] and free e-bike trials [8] are also recommended. [6] proposes offering low prices for high quality bicycles, as well as bicycle training. Initiating team-based bike commuting [8] will have several positive effects, among which increased female bicycle usage. To further encourage people to use an active travel mode or the public transport, Devi [6] proposes arranging a campus shuttle bus and weather protected walking and cycling lanes. For the UT, where bicycle usage is already high, it would be interesting to incorporate team-based biking in the travel check.

To increase sustainable travel, providing stability and fixed times could help. Sargisson [7, p. 198] hypothesizes that "the variable commuting schedules of students are a potential barrier to alternative forms of transport, such as carpooling, and alternatives to car travel are more viable when commuting occurs regularly and within fixed timeframes". Therefore, [7] suggests encouraging students to stay on campus by providing locker space, as well as social and study spaces. In addition, housing on campus or nearby is recommended [5, 7]. These measures could be implemented by the UT itself, but are not usable for the proposed travel check application.

Next, some measures focus on information provision and awareness. Khan et al. [4] suggest that people should be educated about sustainable travel, but Sargisson [7, p. 189], remarks that "simply providing information about the environmental or financial costs of commuting by car seems to have little effect on car use". Providing info on alternative travel modes [4], or even providing personal assistance with regards to alternative travel modes [5] is suggested. This indicates that a travel check application could support sustainable travel by providing clear information and suggesting alternative modes of travel. Zhou [10] suggests that mode specific policies should be implemented and [4] suggests that measures should be directed mainly towards staff, as students are already travelling sustainably more often. Travel plans should be objective driven and monitor travel data [4], which also demands collaboration among

stakeholders [9]. Taking these suggestions into account, a travel check application for the UT could thus benefit from focusing on staff and monitoring travel data.

Naturally, preventing travel would be most sustainable. Therefore, universities should commit to telecommuting [4], online lectures [4, 7] and pre-recorded lectures [4]. Choosing to stay at home or using a sustainable travel mode should also be compensated or rewarded [9, 11, 12]. This can be encouraged by the travel check application but would also need policy from the UT that most of the lectures can be watched from home.

Even though this literature review focuses on measures that can be implemented by universities, the governmental measures should not be left unmentioned. As was also explained in the second chapter, universities have an important role in society and should be able to influence government plans. Therefore, it is suggested that universities cooperate with the government about the measures set out below.

Overall, there are many measures that can be implemented by universities to incentivize sustainable travel. Discouraging private car travel, encouraging active travel, increasing awareness and preventing travel by stimulating online education are the most important principles that universities can implement now.

2.1.3 Conclusion
The goal of this literature review was to find out how universities can incentivize students and staff to choose alternative, sustainable modes of travel. It was determined that various measures can be taken by a university. Parking fees should be increased, while the amount of parking spaces should be reduced. Initiating car-pooling and offering car-poolers incentives such as discounts on parking is also suggested. Parking subscriptions should not be offered: people should have to buy a new parking ticket each time. On campus, safe parking facilities for bicycles should be provided, as well as showers. (E-)bike renting or leasing will increase bicycle usage, and to increase overall active travel a shuttle bus and walking/cycling lanes that are protected from weather are suggested.

People should be informed and educated about sustainable travel and the different travel modes available. Travel plans should be objective driven and monitor all travel data, which asks for collaboration between all stakeholders. Online lectures, telecommuting and pre-recorded lectures will allow people to work from home, thus reducing travel. The university can use rewards or compensation to further incentivize sustainable travel choices. Finally, the government plays an important role as well. Public transport should be subsidized and made more attractive by increasing among others comfort and accessibility. Walking and cycling routes and infrastructure should be provided and free parking near the university area should be limited.

There are some limitations and remarks that can be made about this literature review. First, not all the found measures can be used for the intended goal of making an application that nudges users to choosing a sustainable travel mode. For example, the application has no use for the notion of increasing the cost of parking. This can also be said for online meetings and lectures, as this must be organized by the university itself. However, the application can encourage meeting online with peers, as well as provide the information on parking costs. Another limitation is the fact that the University of Twente is located in the Netherlands, a country known for good cycling infrastructure and high bicycle usage. Many of the measures focus on increasing bicycle usage, but it could be argued that this is already at a maximum level in the Netherlands. Therefore, further research should be conducted to find out whether bicycle usage at the UT can even be increased. Furthermore, many studies recommend subsidized or even free public transport, which is already the case in the Netherlands. To what extent and how the UT could increase public transport usage when it is already subsidized, is therefore unclear and should be researched further.

In the context of the travel check application the UT wants to develop, seven measures can be identified that should be considered when developing a travel check application. These measures are listed below:

1. Initiate carpooling: create or link to a platform that matches drivers and riders from the University of Twente.
2. (E)-bike renting/leasing: establish contracts with bicycle providers and offer discounts to users of the travel check application.
3. Information provision: provide information on pros and cons, prices and sustainability of each travel mode, as well as general information about the importance of sustainability.
4. Online education: Stimulate telecommuting by providing online or pre-recorded lectures and supporting online peer meetings.
5. Rewards or compensation: by giving (financial) rewards, application users will be more likely to choose sustainably.
6. Monitor travel data and collaborate: by gaining insight into all travel activity, policy and approach can be shaped to target unsustainable groups.
7. Team-based biking: initiating team-based biking can encourage more people to travel by bike.

Conclusively, universities can play an important role in contributing to sustainable travel and have many tools to make an impact. The travel check application should focus on encouraging carpooling and (e)-bike rental/leasing, while providing clear information about the different modes of travel and monitoring all travel activity. Additionally, telecommuting should be stimulated and sustainable choices should be financially compensated or rewarded.

2.2 State of the Art

2.2.1 Introduction
This section provides an insight into the current status of travel checks as employed by other universities. It provides strengths and weaknesses that can be taken into account when developing the travel check for the UT.

2.2.2 Travel Check Utrecht University
Currently, for lack of an own travel check, the website of the UT [2] refers to the Travel Check of Utrecht University (Figure 2.1) [3]. This travel check is created in the form of a PDF, which has clickable elements to increase interactivity. This document is similar to what the UT wants, as it provides information about travel options and tries to incentivize sustainable travel. A strength of this travel check is that it is interactive, in the sense that it asks for input and suggests options based on that input. Additionally, it provides information or refers to other documents or services, as was also suggested by studies presented in the literature review. Besides, it stimulates telecommuting and points out that there are, for example, train funds available while linking to these funds. These features match recommendations 4 and 5 respectively from the literature review.

However, there are also weaknesses. For instance, the travel check is only focused on longer trips, thus disregarding possibilities for active travel (walking and cycling). It is also questionable to what extent users will keep consulting the travel check, as once they have seen all the options, there is no further need to keep on using it. Another flaw is that by designing it as a PDF document, choices and activity can not be tracked. Of course, travel can also be monitored through other means, but by keeping track of how users interact with the travel check and how this influences their travel, patterns can be deducted and the travel check can be improved in areas where it does not perform as intended. Besides, this type of travel check does not allow for exchanging data with another party (such as the travel agency), which is suggested by recommendation 6 of the literature review.
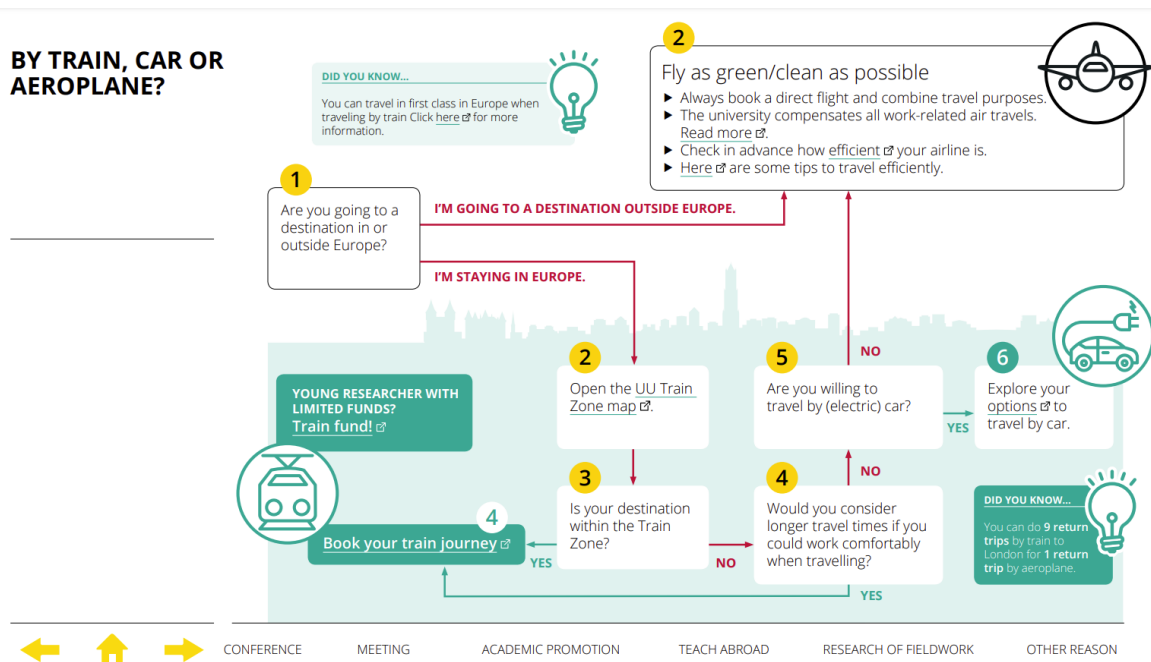
Figure 2.1: Screenshot of Travel Check Utrecht University

In all, the travel check by Utrecht University (UU) is a good starting point for designing the travel check of the UT, but lacks in several areas such as reusability, data tracking and shorter trips where active travel modes can be used.

2.2.3 Train Zone Map Utrecht University

Also referred to by the UT, the Train Zone Map by UU (Figure 2.2) [13] shows travel times of both train and airplane for frequently visited destinations in Europe. The document clearly indicates to what cities it is expected that one takes the train. Additionally, key factors of the travel are shown, such as number of transfers, comfortability, difference in travel time to airplane and CO_2 emission. At the last page, the document displays tips for booking a train journey.

What stands out is the clear information provision. Most importantly, the difference in CO_2 emission between train and airplane is shown, which is huge. Taking that into account, when there is only a small difference in travel duration, it becomes more likely that one will travel by train.

The train zone map is a standalone document, but is referred to by the travel check. It does not provide information on subsidies that are available to students and staff. The document might be more effective as a part of the travel check, as the travel check is interactive anyway and only shows the information that is useful to the user based on their inputs. By putting it straight in there, users who want to travel are more likely to find it and get convinced of travelling by train.

destination			travel time			CO_2 emission (kg)		number of transfers	
United Kingdom (2)		🚊	difference	✈	🚊	✈	🚊	✈
Southampton		7:30	2:40	4:20	31	304	3	2
York		7:00	0:50	6:10	42	300	3	3
France (1)								
Belfort	c	7:00	1:25	5:35	52	332	2	3
Cannes	c	10:00	4:30	5:30	31	650	2	3
Compiègne	c	5:00	0:40	5:40	20	240	2	3
Lille		2:50	3:00	5:50	15	176	2	3
Lyon	c	6:30	1:50	4:40	17	402	2	2
Marseille	c	9:00	4:00	5:00	29	516	2	2
Monaco	c	11:00	4:00	7:00	32	648	3	3
Montpellier	c	8:00	3:00	5:00	26	648	3	2
Nantes	c	7:00	2:30	4:30	22	402	2	2

Figure 2.2: Screenshot of Train Zone Map Utrecht University

2.2.4 Travel Check Wageningen University & Research

This travel check of Wageningen University & Research (WUR, Figure 2.3) [14] is similar to the travel check of UU, as it is also an interactive PDF document. However, there is less space for in user input, as it only asks whether physical presence is required, whether the destination is in Europa and ultimately whether travel by train would take more than eight hours. When reaching a decision, the corresponding page has a lot of text which might be off-putting to read. Interestingly enough, this travel does contain the travel zone map, but is missing detailed comparisons between travel by train or airplane. The travel check does not explicitly try to incentivize sustainable travel, but seems to focus merely on information provision. Like the UU travel check, the WUR travel check only focuses on longer (work) trips and disregards short (commuting) trips.

In all, the travel check by WUR appears to be similar but inferior to that of UU, even though it did include a train zone map. With that in mind, there is not much reason to elaborate further on this travel check.
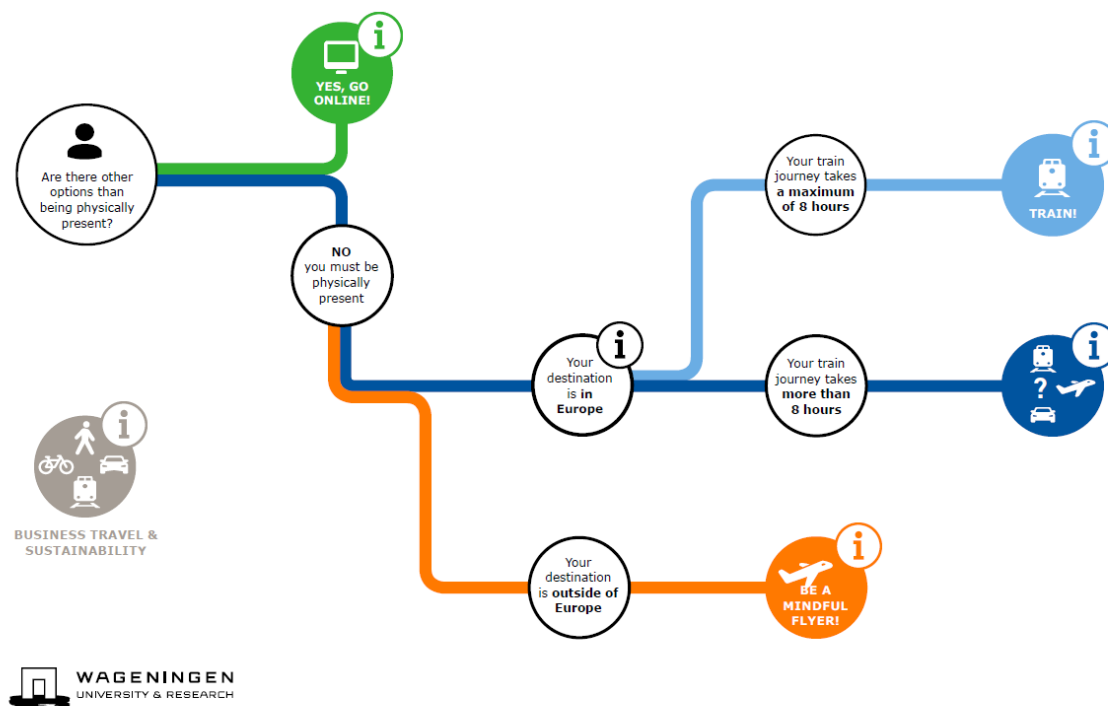
Figure 2.3: Screenshot of Travel Check Wageningen University & Research

2.2.5 Decision Tree & Train Zone Map RUG

The University of Groningen (RUG) [15] chose to implement a less extensive version of a travel check in the form of a decision tree (Figure 2.4) and a train zone map (Figure 2.5). The decision tree consists of two questions, that will lead you to either staying at home, taking the train or taking the plane. There is extra information about the possibility to travel by electric car, but no information is provided on how this can be done or where this can be arranged. Additionally, a block of text reminds people that taking the plane will cost an additional two hours for the journey to the airport, check-in time and transfer time. A first impression is that it seems to be a quick and dirty solution: If you use it, one time is enough to know exactly what you should do. Indeed, this could be a good thing (easy to use) but from the perspective that you want people to be making conscious decisions every time, it seems like this solution of a travel check is not really effective.
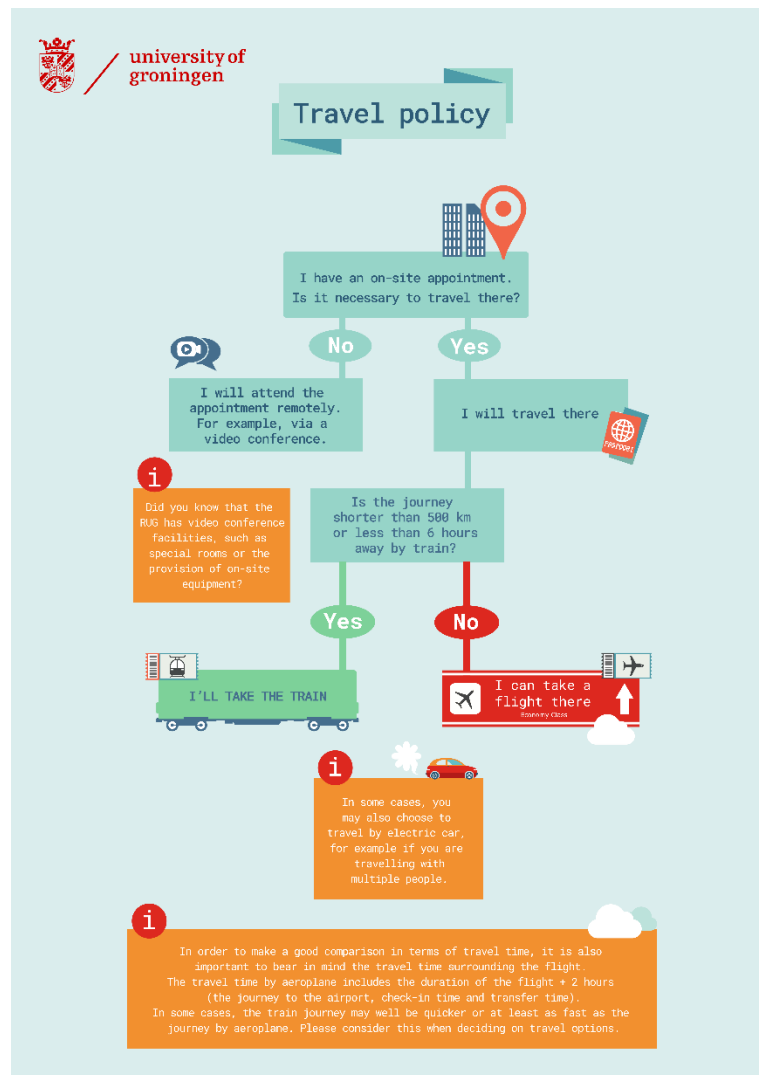
Figure 2.4: Decision Tree of University of Groningen

What also stands out is that Groningen set a limit of up to 500 kilometers for using the train, whereas this is 800 kilometers for the UT. This can also be seen in the train zone map (Figure 2.5), where the color code indicating whether you should take the train has been set to red (train possible, but not recommended) for destinations such as Nantes and Geneva. These are indicated with yellow (usually by train) in the Utrecht train zone map (section 2.2.3). Moreover, the Groningen train zone map does not provide any information about CO2 emissions for most of the destinations. It is basically an inferior and less detailed version of the train zone map of Utrecht. A positive remark are the good aesthetics, as it is nice and interesting to look at.

In conclusion, there is much that can be improved for the decision tree of Groningen, but since it is not even labelled as an actual travel check, it might be unfair to treat it as such. The train zone map is also not as extensive as it could be, but has a nice visual implementation.
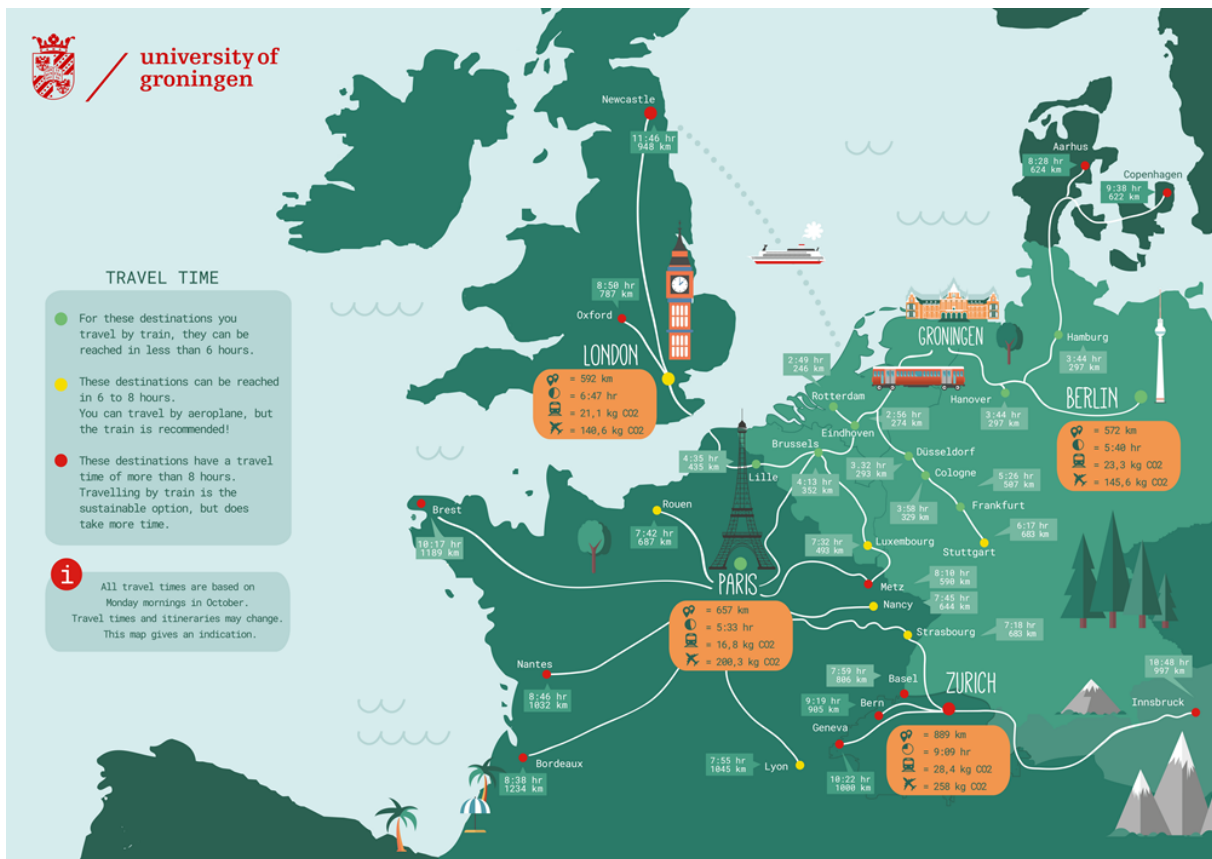
Figure 2.5: Train Zone Map of University of Groningen

2.2.6 Conclusion

Having looked at the travel checks that are already out there, several strengths and weaknesses have been identified. The strengths that should be implemented in the travel check for the UT include:

1. Information provision: The travel checks provide information about several types of travel and refer to grants, tips and additional information. The train zone map compares travel by train and airplane and describes the key factors to take into consideration.
2. Interactivity: By basing the suggestions on user input, the user gets a more targeted experience. This will prevent them from being overloaded with information that is unnecessary and irrelevant.
3. Support telecommuting: The UU travel check highlights working from home. This should be the starting point and travel options should only be suggested when physical presence is absolutely necessary.

In terms of weaknesses, the travel check of the UT should try to come up with solutions to the following:
1. Include shorter trips and commuting.
2. Add incentives to keep using the travel check.
3. Track interaction data and monitor travel, collaborate with travel agency.
4. Add train zone map and comparisons to the travel check itself.

2.3 Expert Interview

Another thing that should be taken into account was something that was encountered in a conversation with Brechje Marechal, the policy officer for environment and sustainability. In this conversation, she explained that it is difficult to give meaning to numbers. The sustainability department put the energy data online, but just the numbers were meaningless to people. By comparing the usage to more tangible numbers, they tried to make it meaningful: "The amount of energy used today equals thousand toasted sandwiches. But still, then people see that once but it does not spark people into action continuously."

This made me aware of how difficult it is to persuade people into using other modes of travel when their impact is not clear enough. When designing the UT travel check, it should be tested what comparisons, incentives and numbers work and what does not.

2.4 Conclusion

In the State of the Art research, several things were found. Through the literature review, seven recommendations were found that should be taken into account for the UT travel check. These recommendations were then used to evaluate the existing travel checks from UU, WUR and RUG, which appeared to be good starting points. Three strengths were identified that should be adopted in the UT travel check, as well as four weaknesses which should be solved in the design of the travel check for the UT. Finally, an interview with the client made it clear that it is hard to give meaning to numbers, therefore making it difficult to persuade people.

3. Ideation & Requirement Capture

In this chapter, an initial analysis of possible solutions is made to find out the requirements for the goal of the project: creating an interactive travel check application. Through stakeholder analysis, idea generation, user scenarios and a discussion with the client, a list of initial requirements is generated.

3.1 Stakeholder Analysis

3.1.1 Introduction

In order to get a better overview of the users in the context of the eventual application, a stakeholder analysis is conducted. A stakeholder can be defined as "any group or individual who can affect or is affected by the achievement of the organization's objectives" [16, p. 856]. To get more information about the users who are affected by the application, the stakeholder identification methodology of Sharp, Finkelstein & Galal [17] is used.

This framework dictates that each possible stakeholder is put into one of the following four groups: users, developers, legislators, and decision makers.

- Users are "the people, groups or companies who will interact with the software and control it directly, and those who will use the products (information, results etc) of the system" [17, p. 3].
- Developers could include "could include analysts, designers, programmers, testers, quality assurance representatives, maintainers, trainers, project managers" [17, p. 4]. In short, they are the people that are in charge of the development of the application.
- Legislators are the people that "produce guidelines for operation that will affect the development and/or operation of the system" [17, p. 3].
- Decision-makers are the people that have the power to play a role in the decision making process. "The kinds of stakeholder here would include managers of the development team, user managers and financial controllers in both the developer and the user organisation [17, p. 3].

After having classified the stakeholders in the categories, a graphical representation of the interest and influence on the project for each of the stakeholders can be made. Eden and Ackermann [18] created a power-versus-interest matrix, with the advantage of being able to quickly identify the interests and influences of several stakeholders. The interest of the stakeholders is plotted on the x-axis, whilst the influence is plotted on the y-axis. Figure 3.1 shows how the stakeholders are ranked within the context of this project.

3.1.2 Stakeholders

Professors
Professors might be the main target group of the travel check. Business travel is one of the largest polluters and by incentivizing more sustainable travel modes, the CO_2 emission could be cut down significantly. Therefore, it is important to find out how professors feel about a travel check and what factors are at play when travelling abroad.

Secretaries
Secretaries assist professors in several tasks, including scheduling. Supposedly, they are also responsible for booking travel appointments and will therefore be potential users of the travel check. The main focus lies on finding out to what extent secretaries are responsible for booking trips and what this booking process currently looks like.

Students
The travel check will focus on students and staff of the UT. Therefore, students can be identified as stakeholders in the sense that they will be the users of the application. The travel check should encourage students to travel sustainably, both when commuting and when making study trips.

Other staff
Apart from students and professors, the travel check application aims to increase sustainability for all UT-related travel. Therefore, another group of potential users is the remaining staff. This is mainly about commuting, although it is unclear whether there are more occasions for traveling; this should be investigated.

Study Associations
Study Associations organize study trips abroad, as well as small activities. This means this group should not be forgotten when designing the travel check: ensuring sustainable travel by study association initiatives will further contribute to the overall goal of increasing sustainability in mobility.

University of Twente – SEG Sustainability group & Brechje Marechal
The UT established the Sustainability Team as part of their Shaping 2030 policy. As stated before, the goal is to reduce CO2 emission and the travel check could help achieve this goal. The UT, and the sustainability team in particular, are therefore the indirect clients of the travel check. Their interest lies in increased mobility sustainability. The project is commissioned by Brechje Marechal, who is a member of the SEG Sustainability group and works as an Environment & Sustainability Policy Officer and Programme Manager SEE. She is the direct client of the travel check.

Supervisors
Job Zwiers and Champika Epa Ranasinghe are the supervisors of the project, meaning they have an interest in getting the best application as possible within the given time. Brechje Marechal, the client, provides information and requirements.

NS/Rail Service/Train organizations
Travelling by train is a sustainable alternative for travel by car or plane. In the Netherlands, the NS (Nationale Spoorwegen) is the main train transporter, which is directly affected by the travel check: if the travel check would have the desired effect, more people would travel by train. Besides, the UT currently has an arrangement with the NS which gives staff access to a business card, allowing for discounted travel [19].

Bicycle Shops/Rentals
Since traveling by bicycle is a sustainable mode of travel and the Netherlands have excellent infrastructure in place for cycling, the travel check could lead to an increase in bicycle usage. This would mean an increased demand for bikes, both in terms of purchases and rentals. Similar to the arrangement with the NS, the UT could consider cooperating with bike shops to provide discounts for UT students and staff when buying or renting a bike.

Airlines
Although airlines are not influencing the development of the travel check, they are directly affected because of a reduction in UT travel by airplane. However, sometimes it is unavoidable to travel by plane. In these scenarios, it could be interesting to strive for the most sustainable type of flight.

3.1.3 Stakeholder Roles
The identified stakeholders can now be grouped in either users, developers, legislators and decision makers.

- Users: The travel check is aimed at staff and students of the University of Twente. However, the application can also be used for anyone that is interested in information about sustainability,

although the user experience might not be as personal as that of someone related to the UT. Other, indirect users are train organizations, airlines and bicycle shops.

- Developers: The researcher of this project is Joshua van der Meer, which makes him the developer of the application.
- Legislators: The SEG Sustainability group provides the guidelines for the development of the application.
- Decision Makers: There are several decision makers. The first that can be identified is the researcher, Joshua van der Meer. Subsequently, Brechje Marechal is the client, meaning that she has a large influence on the resulting application. The researcher is of course also relevant to the decision making. Finally, the supervisors Job Zwiers and Champika Epa Ranasinghe are involved.

3.1.4 Result of Stakeholder Analysis

With the previously gathered information, a schematic overview of the stakeholders could be completed (Table 3.1) and the interest-influence matrix could be created (Figure 3.1).

	Stakeholder	Category	Interest in project	Influence on project
A	Professors	Users	Medium	High
B	Secretaries	Users	Medium	High
C	Students	Users	Low	Medium
D	Other staff	Users	Medium	Medium
E	Study Associations	Users	Low	Medium
F	Train Organizations	Users	Low	Low
G	Bicycle shops/rentals	Users	Low	Low
H	Airlines	Users	Low	Low
I	UT – SEG Sustainability Group	Legislators/Decision Makers	High	High
J	Supervisors	Decision Makers	High	Medium
K	Joshua van der Meer	Developers/Decision Makers	High	High

Table 3.1: List of Stakeholders Grouped by Category and Ranked on Interest and Influence
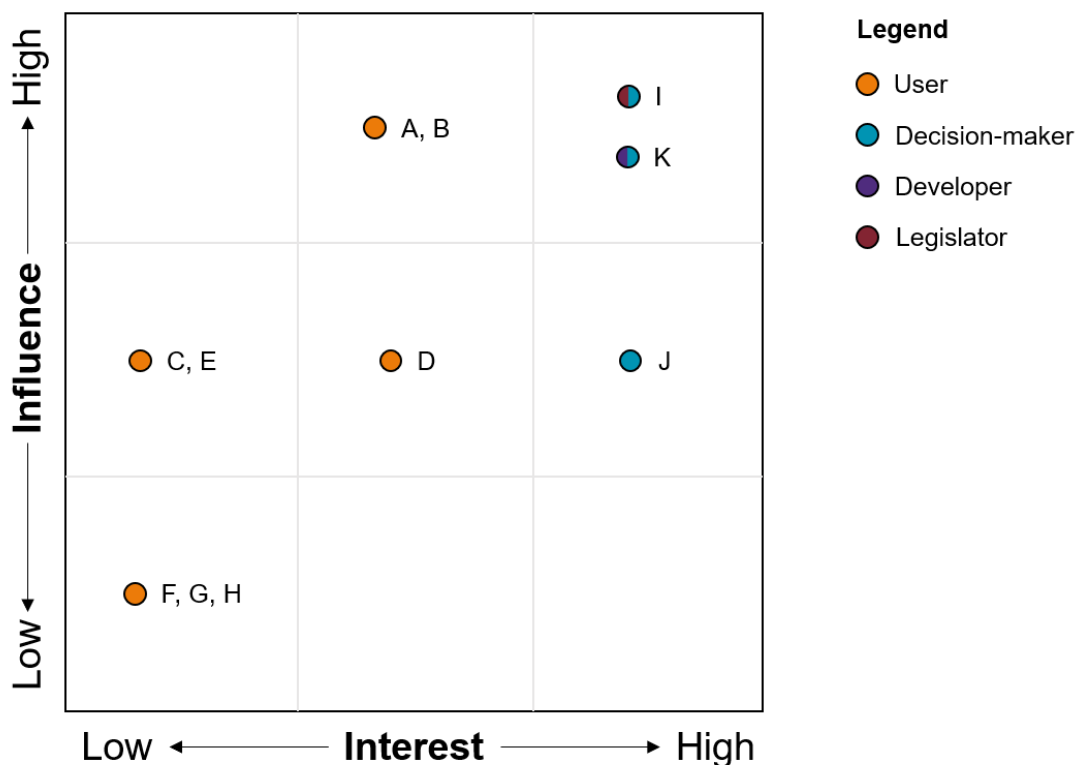
Figure 3.1: Influence -interest matrix for the stakeholders in the context of the travel check

3.2 Idea Generation

In the first few weeks of the project an individual brainstorm session was held to explore some ideas that could be valuable to the travel check. Since the project was quite 'framed' (in the sense that the goal and the method were clear), the main thing to think about was what extra features could be added on top of the basic travel check. The following ideas were conceived:

- Main idea: application with similar functionality to the Utrecht Travel Check
- Works as a decision tree that will ultimately lead you to the best options and suggests the most sustainable
- Add a leaderboard/scoring functionality that assesses points to each decision. Could also be minus points for unsustainable options.
- Each employee has an account (but is not necessary to quickly check the most sustainable option)
- All the travels should be booked through travel agency
- Make restrictions on some of the locations, e.g. London only by train
- Use incentives (points/money) to make the sustainable options more attractive
- Every page has links to useful related stuff, such as 'where to buy a bike' or 'how to have great video conferences' or 'where to get video conference material' et cetera
- Incorporate application points in job terms
- Set CO2 budget
- Promotion campaign with posters, video, introduction to competition-element
- All sustainability goals are clear and easy to find in the application
- Application cooperates with Travel Agency and gets their data as well so that each user can easily see his emissions
- Application shows clear overview of travel time around flying, showing that travel time in train is much more efficient
- Application gives actual information about weather, train disturbances, amount of traffic et cetera

- Steer towards electrical bike on some distances (10-15km)
- Application also has a database with all workshops, articles and information about video conferencing, sustainability et cetera
- 'Faculty battle:' every quartile, all the faculties battle to get the most sustainability points

These ideas form the basis of the requirements in section 3.3.

3.3 User Scenarios

3.3.1 Louis, student, 19 years old

Louis is a student at the University of Twente since September 2020. He came all the way from France to study something in Enschede that was not available in France. When walking around on campus, a large billboard catches his eye. This billboard seems to be about some new UT-app, called Travel Check. While walking, Louis decides to look up the link that is displayed on the billboard and uses his phone to go to the web application. On the homepage, he clicks a button that says "Take the travel check." Louis gets redirected to a webpage that asks him whether he is an employee or a student. Louis selects student and gets asked for his travel purpose. Since he has no real purpose now, he decides to select 'Visit a lecture'. The webpage shows a list of possible (travel) options, such as watching the lecture from home, taking the bicycle, using the public transportation and an option to subscribe to a 'Ride along'-function, that is explained as some sort of carpooling for UT staff and students. His interest, however, is on the bicycle. Louis has always used the public transportation since he arrived in the Netherlands, but has seen all the other students travel by bike. The bicycle option on the webpage includes information on where he can get a bike, and also information and learning how to ride a bicycle. Louis selects the bicycle and gets all the information clearly visible on his screen. On top of that, some nice statistics are displayed about how much CO_2 emission could be spared if everyone would take the bike for distances < 15 kilometers.

At the bottom of the page Louis sees information about signing up, including a button. "Sign up and compete with your friends to win prizes." Next to that, information is shown about points that can be earned by taking the bike. This gets his attention and he signs up to see what this is all about. Since he wants to compete, he also shares the application with his friends from the study.

3.3.2 Marielle, secretary, 42 years old

Marielle has been working as a secretary to a UT-professor for five years now. A couple of weeks ago, the UT introduced the travel check and had a seminar to explain all the functionalities of this new application to the UT staff. This morning, the professor asked her to book a trip to London. Usually, Marielle would just send the date and details to the Travel Agency, asking them to book a flight. However, this time she remembers the travel check, and decides to look it up. She declares that she is an employee and selects a work trip as the purpose of her travel. Now a question shows up that asks whether the trip could also be visited online. Marielle is in doubt, since the professor clearly demanded that she booked a trip to London. However, she decides to select 'Maybe' and a lot of possibilities to visit the meeting from home show up. This also includes information about where conferencing equipment is present or can be taken home. Marielle is not sure what to do now, and decides to ask the professor using the travel check as support for her question. The professor hesitates for a bit and then tells Marielle he would think about it. "They did mention you could visit from home…", the professor mumbled.

The next day, Marielle receives an email from the professor, stating that he will attend the London conference from his office and asks Marielle to prepare everything in his office so that he can easily participate online. Marielle fires up the Travel Check again to gather the information about video conferencing, picks up the equipment from the specified location and watches a workshop video on how to use the equipment. She is able to set it up rather easily and is satisfied with the result. A few days later the professor comes in and tells her that visiting the conference online worked really well and he was actually glad he had some extra time left to work on other stuff.

3.3.3 Johan, Travel agent at ITC, 38 years old

Johan is a travel agent that has been working at ITC for 2 years now. Since the UT launched the travel check a couple of weeks ago, a lot has changed. All travel must now be booked through the travel agency in order to collect as much data as possible. Additionally, the travel agency has been requested to always provide the most sustainable and fitting travel option first. The travel check application, that also has a train zone map, comes in handy. Whenever Johan gets a request to book a trip, this request always includes the date, the departure place, the destination and the purpose of the trip, along with details about the person and preferences that the user could specify upon placing the request. Using this information, Johan goes through the travel check and gets recommended the best suitable and sustainable travel option. The selected mode of travel can easily be booked, however, a confirmation from the user is needed first. Johan sends an overview of the selected trip and its details to the user and waits for confirmation. Once the user confirms the trip, Johan books it and stores the trip in the database using a single button click on the travel check application.

3.4 Client Discussion

The user scenarios from section 3.3 were introduced to the client to find out whether the expectations and visions aligned. The first scenario with Louis was met with enthusiasm, as it fit the expectations exactly. The idea of having a competitive side to the travel check was praised, and it was suggested to let users that sign up for the application automatically enter a raffle.

Next, the scenario of Marielle was discussed. It was mentioned that it is not always the case that the professor books through their secretary, as sometimes they book directly. Furthermore, it was highlighted that the UT allows their staff to travel with the NS business card, but many professors do not use it as much as the client would want.

For the third scenario, the client suggested to interview some secretaries to get some information about the way that travel is currently booked. Not all travel is booked through the travel agency, although this is necessary for flights.

After having read all the scenarios, some general matters were discussed. First of all, it became clear that the UT is currently working on implementing a carpooling system, with a pilot starting later this year. Therefore, it is not necessary to add this functionality to the travel check itself, but rather link to the service. Furthermore, it was pointed out that staff at the UT is able to get a compensation when they travel by bicycle. This should be mentioned in the travel check, but also shows what is possible within the staff contracts at the UT: In a later stage, positive usage of the travel check could be included in the contract to lead to rewards or higher salaries.

Another suggestion was to inspire bicycle usage by adding nice stories and routes to the travel check. Additionally, a similar feature to carpooling could also be set up for cycling, such that people can cycle in groups (team-based biking).

The client mentioned that at the moment, there were no clear insights into study trips. Study trips are organized by the study associations and often go to distant destinations such as the United States or China. It was recommended to add study trips to the travel check, which would be completely new as it was also not seen in the travel checks of other universities (section 2.2).

Finally, a web application would work best for staff, as it can be easily reached from both pc and phone and does not require a download.

3.5 Initial Requirements

3.5.1 Introduction

Having collected all kinds of information and requirements, an initial list can be created that describes what functionality should be included in the travel check. To do so, the MoSCoW method from

Ahmad et al. [20] is used. This method helps categorize and prioritize requirements in either 'Must Have', 'Should Have', 'Could Have' or 'Will Not Have'.

3.5.2 Must Have
1. Application must allow for user input (destination, purpose) and serve travel suggestions based on that.
2. All possible travel options must be displayed and information about pros and cons and sustainability must be provided.
3. The information from the train zone map must be incorporated in the application.
4. Supporting links related to discounts, grants and more information must be provided for each travel mode.

3.5.3 Should Have
5. The application should have an authentication system so that users can log in, track their activity and get an overview of their impact on sustainability.
6. The application should clearly provide an overview of sustainability goals at the UT.
7. The application should steer towards the most sustainable mode of travel in a given context, e.g. an electrical bicycle for distances of 10-15 kilometers.
8. A database with articles regarding discounts, information about video conferencing, information about sustainability in general and so on should be available in the travel check.
9. Moderators should be able to edit and add content to the travel check.
10. The data and activity of each interaction should be stored and monitored to gain insights in travel behavior.

3.5.4 Could Have
11. A promotion campaign could be developed to gain attention.
12. A connection could be made to the travel agency so that all travel activity can be booked instantly from the travel check application.
13. Initiatives for team-based biking and interesting biking routes could be provided.
14. A competitive system could be introduced that tracks and assigns 'sustainability-scores', allowing for sustainability-battles between individuals, studies and faculties.
15. Staff could be awarded a periodical 'CO2-budget', which will be taken into consideration when making travel choices.
16. The travel check could serve information about the weather, delays in public transport and amount of traffic.
17. Webhare / UT

3.5.5 Will Not Have
18. Points earned for sustainable choices will not yield a (financial) reward or compensation.
19. Sustainable incentives related to the travel check activity will not be included in job terms.

4. Specification

The specification provides a clear overview of what should be developed. Included are wireframes to show what the general look of the travel check should be. Additionally, the underlying decision tree is described and explained, and the initial requirements from the previous chapter are discussed with the client. This ultimately results in a list of final requirements.

4.1 Wireframes

To get a better view on what the final prototype of the travel check should look like, several wireframes have been designed. A complete overview of all the wireframes is included in Appendix 4. One of the wireframes can be seen in Figure 4.1, that shows how the application would look on a larger screens (pc/tablet) and smaller screens (mobile phone).
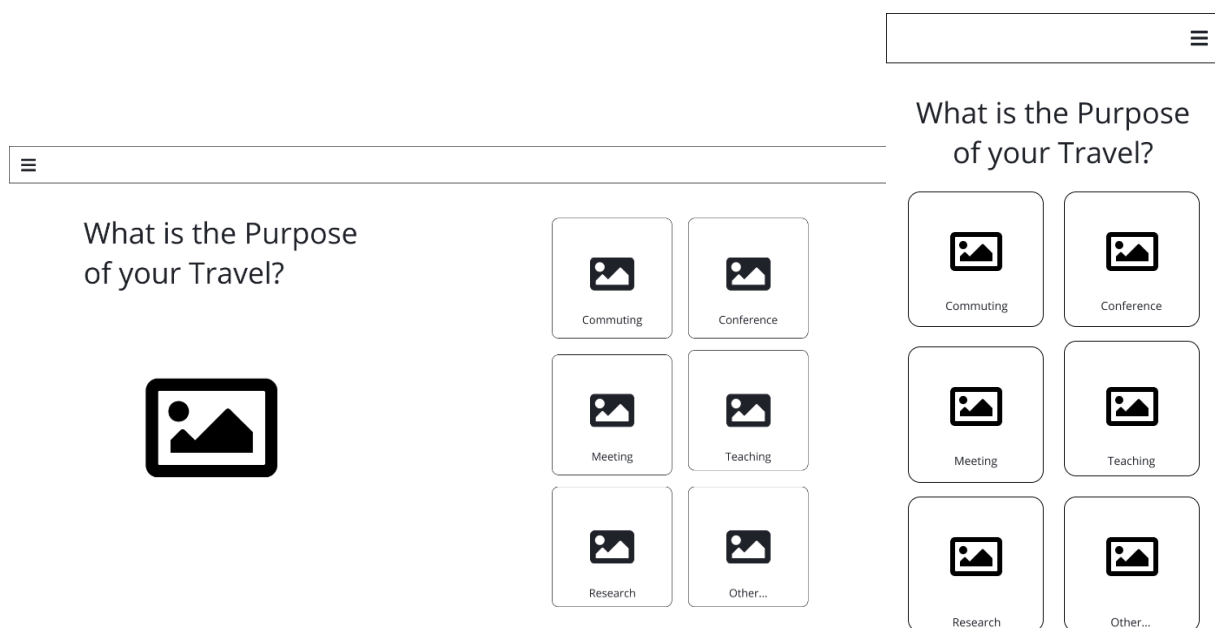

Figure 4.1: Wireframes for both large and small screens

The design of the wireframe should serve as support in visualizing the application and how all the functions and requirements could fit in.

4.2 Requirement Discussion with Client

In an online meeting with the client, the requirements from section 3.5 were presented and discussed. The first remark was that the purpose for travel can be standardized and does not really impact the decision to travel; only for commuting and study trips a different 'path' is necessary, the other travel purposes can be categorized as 'other.' The requirement that the train zone map gets included in the travel check was met with the note that this data was not available yet, and that placeholder data should be used.

The customizability of the pages was important, as lots of things could change in the future. However, it should have a main focus on the upcoming 10-15 years, so it can be static to some extent. There were also some privacy concerns: to what extent is it acceptable to track choices from users or retrieve their location? A solution could be to ask for permission in the settings.

It was pointed out that there is a communication advisor in the sustainability department who could be contacted about a promotion campaign. Additionally, it was brought to my attention that the website of the UT is built in WebHare [21], which might also be an option for the travel check. This could also be discussed with the communication advisor.

Making a connection to the Travel Agency is interesting, but too difficult now, since travel is sometimes booked directly and sometimes through third parties. This requirement moves to *Will Not Have*. The suggestion of encouraging team-based biking was nice, but could be linked to TwenteMobiel Fietsmaatjes [22] that already has something similar.

The CO2-budget is something that the UT wants to implement, but is too difficult yet as not all the data is adequately collected. This requirement therefore also moves to *Will Not Have.* For encouraging sustainable travel modes, the remark was made that comfortability and fewer transfers sometimes outweigh duration and distance.

4.3 Decision Tree

How answers lead to different outcomes can be best visualized by a decision tree. Figure 4.2 shows a segment of the decision tree that was designed to lay out the underlying model of the travel check. To view the full decision tree, see Appendix 3.
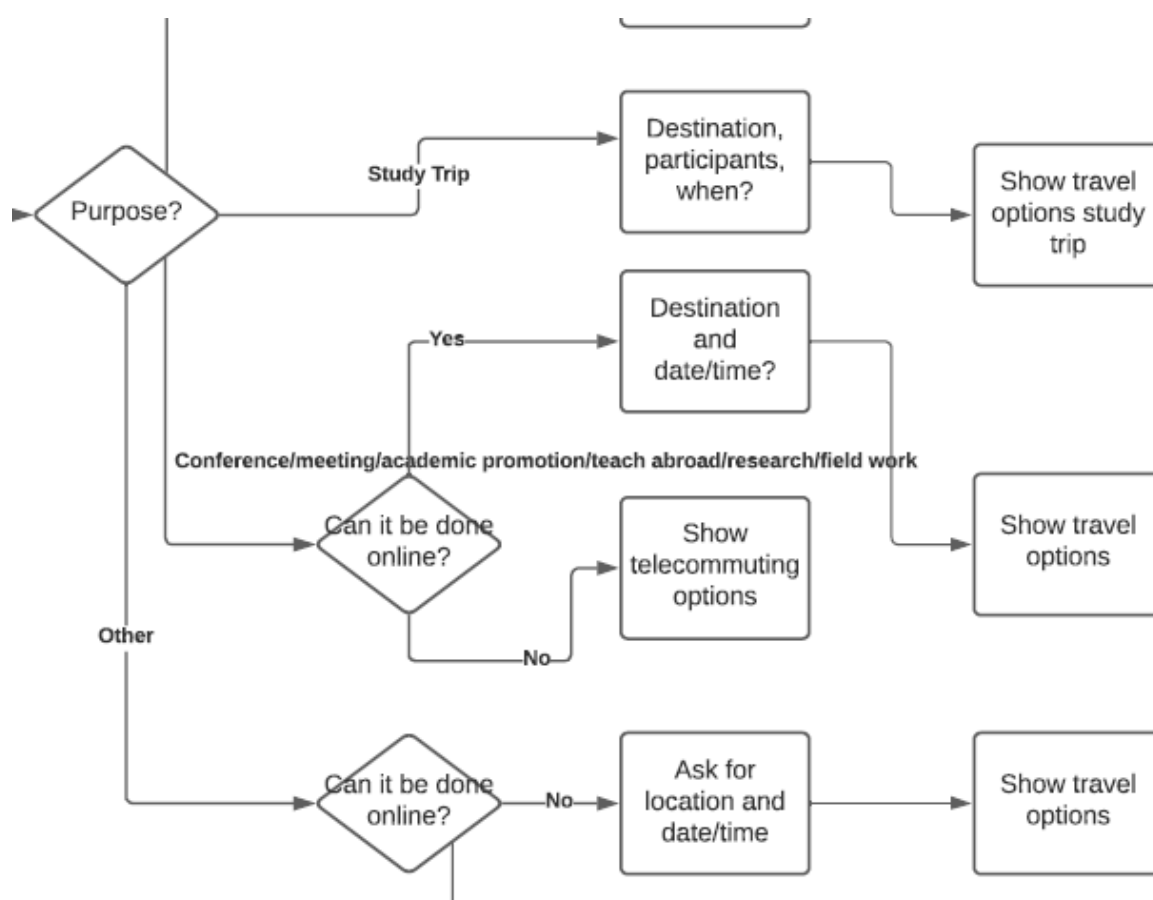
Figure 4.2: Segment of the decision tree, the underlying model of the travel check

4.4 Requirements Iteratively Added in Realization Phase

When starting to build the application, several new requirements popped up. It soon became clear that the speed of the application was important and that it should be as fast as possible. Additionally, matters such as security, SEO (Search Engine Optimization), responsiveness and fitting in with the UT website in terms of style and authentication system were added to the list of requirements.

4.5 Final Requirements

Based on the newly found information and insights, the final requirements are the following. These requirements are used to evaluate the application in the end, as well as provide a clear overview of what needs to be build and what elements have priority over others.

4.5.1 Must Have
1. Application must allow for user input (location, destination, date) and serve travel suggestions based on that.
2. All possible travel options must be displayed and information about pros and cons and sustainability must be provided.
3. The information from the train zone map must be incorporated in the application. Placeholder data can be used for the prototype.
4. Supporting links related to discounts, grants and more information must be provided for each travel mode.
5. The application should be responsive, in the sense that it can be used on all types of screens.

4.5.2 Should Have
6. The application should have an authentication system so that users can log in, track their activity and get an overview of their impact on sustainability.
7. The application should clearly provide an overview of sustainability goals at the UT.
8. The application should steer towards the most sustainable mode of travel in a given context, e.g. an electrical bicycle for distances of 10-15 kilometers. Comfortability and fewer transfers sometimes outweigh duration and distance.
9. A database with articles regarding discounts, information about video conferencing, information about sustainability in general et cetera should be available in the travel check.
10. Moderators should be able to edit and add content to the travel check.
11. The data and activity of each interaction should be stored and monitored to gain insights in travel behavior.
12. The application should fit in with the main UT website: same look and feel, but also same authentication system.
13. The application should be fully secure.

4.5.3 Could Have
14. A promotion campaign could be developed to gain attention.
15. Initiatives for team-based biking and interesting biking routes could be provided.
16. A competitive system could be introduced that tracks and assigns 'sustainability-scores', allowing for sustainability-battles between individuals, studies and faculties.
17. The travel check could serve information about the weather, delays in public transport and amount of traffic.
18. Add feedback option in the application.
19. The travel check could be built in WebHare, the CMS of the UT website.
20. The application could be optimized for search engines.

4.5.4 Will Not Have
21. Points earned for sustainable choices will not yield a (financial) reward or compensation.
22. Sustainable incentives related to the travel check activity will not be included in job terms.
23. A connection could be made to the travel agency so that all travel activity can be booked instantly from the travel check application.
24. Staff could be awarded a periodical 'CO2-budget', which will be taken into consideration when making travel choices.

5. Realization

The realization phase describes the process of developing the travel check application. Choices, considerations and implementations are explained and a final design is created. Screenshots of the final result are shown and iterations are discussed.

5.1 Programming Software
The first decision that had to be made is deciding what programming language and/or framework would be used to build the application. The researcher is familiar with plain HTML, JavaScript and PHP, as well as the open-source toolkit Bootstrap [23]. The advantage of this would be that little to no time would be needed for understanding the programming language, thus making it possible start developing straight away. The disadvantage is that matters such as security, SEO and fitting in with the main website of UT (along with UT login) are more difficult to achieve.

Another platform that was considered is Laravel [24], a PHP framework which has the benefit of built-in security. However, the researcher has just basic knowledge about this framework and would need a lot of time to learn and understand the language. Besides, SEO and fitting in with the UT website would still need to be addressed as well.

The third option was WordPress [25], well known for easily setting up a website without having to type one line of code. The advantage of WordPress is that security is built-in and creating a static web application would be easy. However, actually programming in WordPress is more difficult and requires you to learn yet another language, also called WordPress (which is based on PHP). Additionally, the other matters are also relevant: SEO and fitting in UT site.

Finally, the CMS (Content Management System) with which the UT website is built was considered: WebHare [21]. WebHare resembles WordPress in that it allows users to create and design pages without having to know HTML or CSS. The main advantage is that you can instantly build in the theme of the UT website, as you only have those components available. Besides, SEO, security and UT login are all arranged. The only disadvantage is that it does not allow for any custom programming, which means that the application could only be static and thus become more like the interactive PDF from Utrecht University.

Even though the final option seemed to be the most advantageous, the decision was made to go for the first option; work with what the researcher is already acquainted with. This was decided in consultation with the supervisor, since the application would first be a prototype and it would be interesting to show what is possible with custom code. Afterwards, the decision could always be made to build it in WebHare, or find a custom solution so that the application can be included on the UT website.

5.2 Setup
Now that it was settled which programming software to use, the development could start. One requirement stated that the application should work for all types of screens (called responsive), e.g. phone, tablet and pc. By using Bootstrap, this could easily be achieved; this toolkit is developed specifically to be responsive and has many CSS classes that can be used. On the private hosting of the researcher a subdirectory was created for the travel check: https://joshuavandermeer.nl/projects/travelcheck.

With the application set up, a basic HTML structure was created including links to bootstrap and JavaScript. A database was created in MySQL and the application was all set to be programmed.

5.3 Make It Fast
One of the requirements stated that the decision tree should work fast, so that the user does not get annoyed. One of the first ideas was to have separate pages for each decision, and just let the 'buttons' link to a new page. This would, however, cause the application to load a new page for every decision,

which could become annoying and time-consuming, especially when the user has a bad internet connection.

To prevent this, the application would need to 'load' all the possible pages once, and then remove and load in the new page once a button is clicked. This could be achieved by using JavaScript and so-called hashes. A hash [26] is the part that follows after the hashtag in a URL, and is often used to keep track of the scrolling, so that you can click on an item and automatically scroll the content that belongs to the hash. In the case of the travel check application, the hash can be used to contain the current state, so that the belonging page contents can be retrieved through this state. Once a user clicks on a certain tile or button, this links to #*hash_of_page* and call the changeState function below. This function updates the current global state of the application and then requests a change of content through changeContent, which in turn uses the global variable to find the corresponding content.

```javascript
//function that changes state when an option is clicked
function changeState(newState) {
  STATE = newState;
  changeContent();
}
```

Of course, at this point using the hash is not necessary, as the system could work merely by using the state variable. However, if a user decides to refresh the page for some reason, this state variable would be lost and the user would have to start all over again. With the hash in the URL, the script can retrieve the current state and make sure that the user can continue where they were at the moment. To implement this, the function getStartingPoint is called once the page is loaded. This function retrieves the hash from the URL and checks if it is not empty. If not empty, the function changeState would be called with the hash as parameter, otherwise it sets the state to the first question.

```javascript
//function that checks current page location on a refresh based on the #... hash
function getStartingPoint(){
  var hash = window.location.hash.substr(1);

  if(hash) {
    changeState(hash);
  } else {
    changeState('purpose');
  }
}
```

With these two pieces of code, the application now only needs to be loaded once, which makes it faster in use and thus more user-friendly.

5.4 Dynamic Content
The application now consists of one page that dynamically loads in content based on the state. This is a simple html page that has some basic code and three important components: question, breadcrumb and content. The code below shows how these are implemented in the html:

```html
...
<div class='container'>
    <nav aria-label="breadcrumb">
      <ol class="breadcrumb" id='breadcrumb'>
        <li class="breadcrumb-item active" aria-current="page">Travel
        Purpose?</li>
      </ol>
    </nav>

    <h1 id='question'>Welcome to the Travel Check!</h1>
    <br />
```

```
</div>

<div class="container" id='content'>

</div>
...
```

The question component is the large title above the content, while the breadcrumb is meant to track the progress of the user while simultaneously providing some navigation. Below these two, the content is displayed. Figure 5.1 shows the first working version of the application.
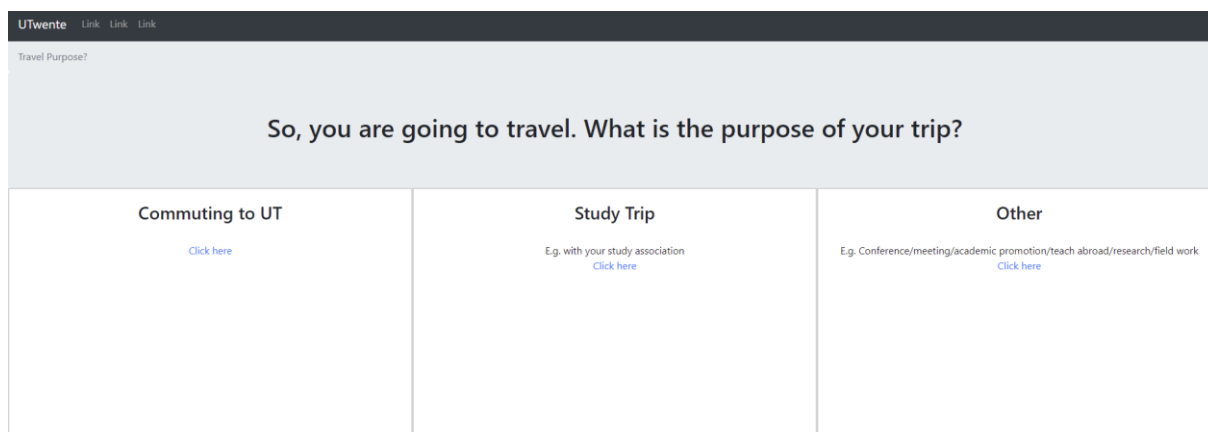

Figure 5.1: Screenshot of the first working page.

The following code shows the function changeContent, which is called whenever a state changes. It shows the different components of a page (question, breadcrumb and content) and how they are filled with dynamic content based on the state.

```
//function that changes the content based on  the current state
function changeContent() {
  //get divs
  var content = document.getElementById("content");
  var breadcrumb = document.getElementById("breadcrumb");
  var question = document.getElementById("question");


  //get correct page information from array
  var index = findWithAttr(PAGES, 'title', STATE);
  var pageToDisplay = PAGES[index];

  ...

  //add new page content
  content.innerHTML = pageToDisplay['html'];
  breadcrumb.innerHTML = pageToDisplay['breadcrumb'];
  question.innerHTML = pageToDisplay['question'];

  ...

}
```

The function findWithAttr retrieves the index of the correct page information from an array PAGES, based on the state variable. In the variable pageToDisplay, the correct page information is stored and then inserted in the content, breadcrumb and question areas of the page.

5.5 Admin Panel

As can be seen in the previous section, the pages are stored in the global variable PAGES. Since there are many 'pages' in the application, some type of content management is needed to keep track. Given the requirement of customizability, the decision was made to create an admin panel that can only be accessed through an authentication form, requiring the correct username and password. This admin panel (Figure 5.2) consists of a simple form that loads the selected page content. This is then editable and can be saved by pressing the button. The result can easily be viewed in another tab by clicking the 'View result' button.

Figure 5.2: Screenshot of the admin page

With the admin dashboard, pages can be easily edited when an update is needed. All the pages are stored in the MySQL database, and are retrieved by PHP and stored in an array when the page is loaded. To make this array accessible for JavaScript (as was used in the previous section), the PHP array finally is converted to the JavaScript array PAGES.

5.6 High-End Sketches and Design

Using Photoshop, some high-end illustrations were designed that should be used as a reference when designing the final prototype. Figure 5.3 illustrates one of the decision screens and Figure 5.4 shows what the recommendation screen should look like.
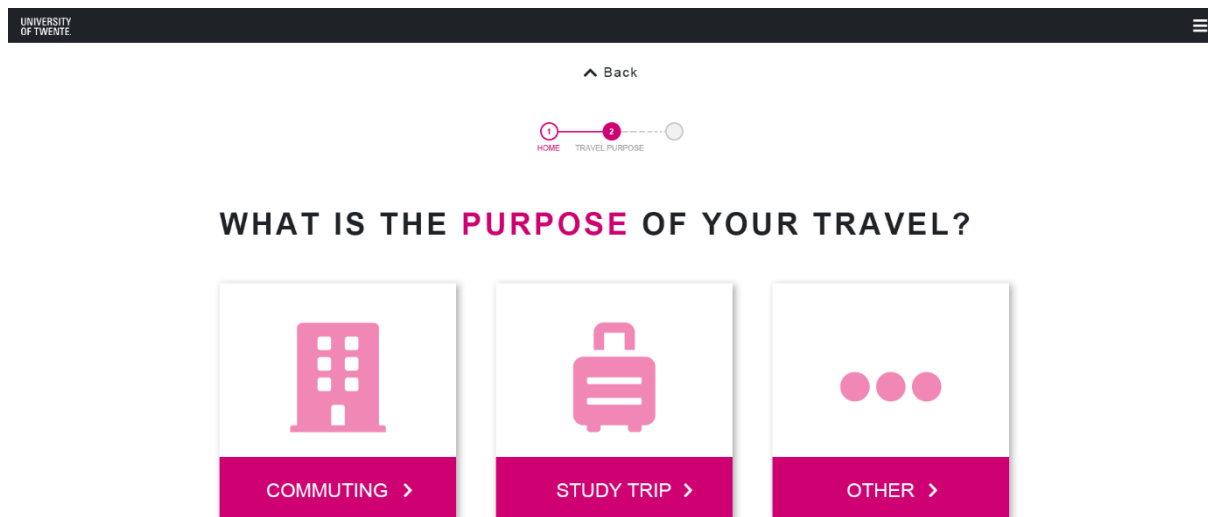
Figure 5.3: Design of a decision screen.
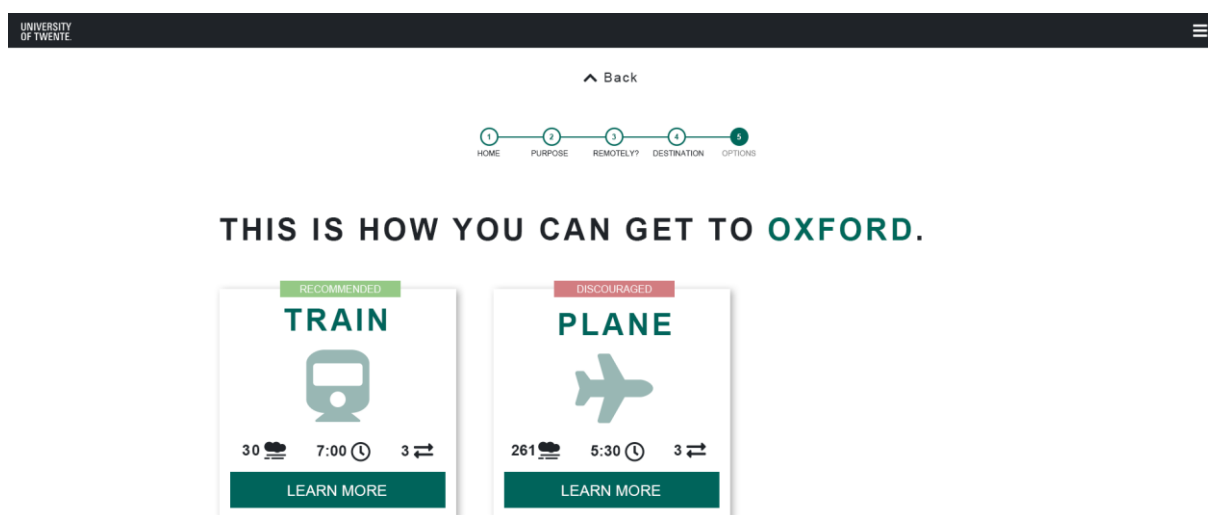
Figure 5.4: Design of the travel recommendation screen.

The designs are based on several elements of the UT house style. The square bars and blocks have been inspired by the UT, whilst the colors are picked from the UT color palette [27].

5.7 Destination Recommendation

For the next step in the realization process, the idea was to have a list of possible destinations (for example the destinations from the train zone map from Universiteit Utrecht, section 2.2.3) that could be recommended to the user based on their input. A rather complex function was needed to achieve this, which can be found below.

```javascript
//function that serves destination suggestions based on input
function recommendDestination() {
    ...

    if(destination.value){
        let a = DESTINATIONNAMES;
        var term = destination.value;
        var search = new RegExp(term , 'i'); // prepare a regex object
        let b = a.filter(item => search.test(item));
```

```
        var c = b.slice(0,6);

        for(var j = 0; j<c.length; j++){
          var suggestion = document.createElement("li");
          var full = c[j].split("|");

          suggestion.innerHTML = full[1];
          suggestion.className = "list-group-item";
          suggestion.id = full[0];
          suggestion.onclick = function(){
            destinationSelected(this.id, this.innerHTML)
          };
          container.appendChild(suggestion);
        }
      }
}
```

This function gets triggered whenever someone types in the search box. If something is typed in, a list with the six best matching destination names (out of an array DESTINATIONS) is stored in the variable c. For each of these destinations, a new element is created that contains an id and the name of the destination. Under the search box, a list of up to six destinations that can be selected is shown (Figure 5.5). The function destinationSelected gets applied when a destination is clicked, in which the DESTINATION variable will get a value. After this, the user can continue and see all the travel suggestions for the chosen destination (section 5.9).

Figure 5.5: Recommendations of destinations based on the input 'de'.

5.8 Location Retrieval

Since there was already a database created for the application, the destinations also got a table containing their name and id. At this point, the researcher realized that it would be interesting for users to find travel information specific to their current location: Suppose you want to get to the Bastille building at the UT, what travel modes can be used to get there from your current location? A quick research made it clear that this could be quite easily achieved: the longitude and latitude of a user can be retrieved once the user gives permission.

```
function getLocation() {
  var button = document.getElementById("locationButton");

  if (navigator.geolocation) {
    navigator.geolocation.getCurrentPosition(showPosition);
  } else {
    button.innerHTML = "Failed to retrieve";
    button.disabled = true;
  }
```

```
}
```

To find out the distance of your location to the destination, the longitude and latitude of the destination were also necessary. Therefore, some locations in Enschede got their geographical data added in the database. With the given longitudes and latitudes of location and destination, the application was now able to serve location-specific travel mode suggestions. The next section describes the travel recommendations in more depth.

5.9 Travel Recommendation

The final and most important part that is discussed here is the way the application manages to serve travel suggestions. To determine what travel modes would fit a given distance, several categories were formed based on the Sustainable Mobility Plan (Figure 5.6) [28] from Brechje Marechal, the client. These categories are as follows:

1. Up to 2 kilometers
2. More than 2 kilometers, up to 7.5 kilometers
3. More than 7.5 kilometers, up to 20 kilometers
4. More than 20 kilometers, less than 800 kilometers or easy to reach by train
5. More than 20 kilometers, more than 800 kilometers or difficult to reach by train
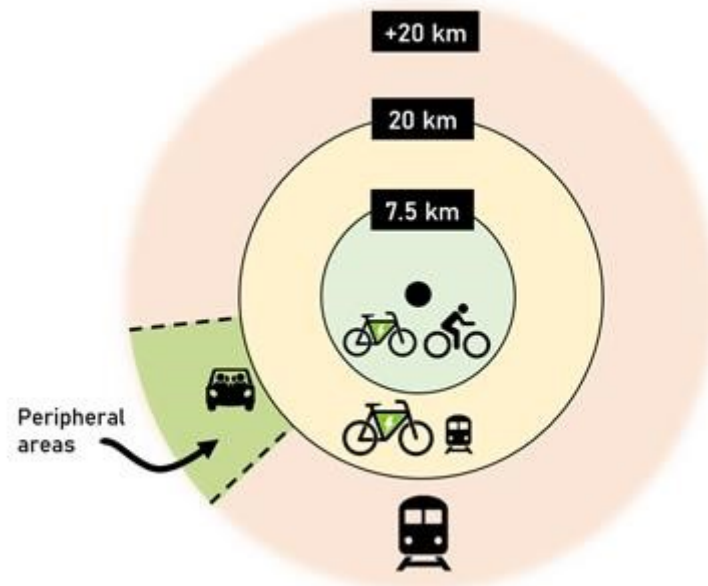

Figure 5.6: Overview of the distances and corresponding travel modes from the Sustainable Mobility Plan.

As can be seen, Figure 5.6 only contains three categories. However, for the travel check there is a difference between distances up to 2 kilometers (walking is preferred) and distances of more than 2 kilometers (walking might be too far, cycling is recommended). Furthermore, it was pointed out that not all cities within 800 kilometers are easy to reach by train; if many transfers are needed, travel duration is disproportionally long and/or comfort is low, an exception could be made which causes the destination to fall into category 5, where plane is the preferred option.

Since the UT does not have their own train zone map, the application is tested with the data from the train zone map of Utrecht University. In addition, some frequently visited destinations of the UT were added that were not in the other dataset. The train zone map of UU contained duration, CO_2 emission and amount of transfers for both plane and train. Besides, it also states to what extent the train trip is

recommended (always train/mostly train/train possible) and whether the train trip is comfortable. This data was used to determine the category of each destination (Figure 5.7).

id	destination	travel_time_train	transfers_train	co2_train	travel_time_plane	transfers_plane	co2_plane	train_recomme	train_comfortable	travel_time_train_minutes	travel_time_plane_minutes	travel_category	latitude	longitude
1	Birmingham	08:00	3	34	04:15	2	285	3	0	480	255	5	0	0
2	Cambridge	06:30	3	29	05:20	3	202	1	0	390	320	4	0	0
3	Cardiff	08:00	3	37	04:20	2	342	3	0	480	260	5	0	0
4	Edinburgh	11:00	3	53	04:30	2	411	3	1	660	270	4	0	0
5	Glasgow	10:30	3	54	04:30	2	441	3	1	630	270	4	0	0
6	Liverpool	08:00	3	40	04:30	2	335	3	0	480	270	5	0	0
7	London	04:30	2	25	04:00	2	217	1	0	270	240	4	0	0
8	Manchester	08:00	3	43	04:20	2	307	3	0	480	260	5	0	0
9	Newcastle	09:00	3	46	04:20	2	326	3	1	540	260	4	0	0
10	Oxford	07:00	3	30	05:30	3	261	1	0	420	330	4	0	0
11	Plymouth	09:00	3	42	06:20	3	399	2	1	540	380	4	0	0
12	Southampton	07:30	3	31	04:20	2	277	3	0	450	260	5	0	0
13	York	07:00	3	42	06:10	3	276	2	0	420	370	4	0	0
14	Belfort	07:00	2	52	05:35	3	240	1	1	420	335	4	0	0
15	Compiegne	05:00	2	20	05:40	3	197	1	1	300	340	4	0	0
16	Lille	02:50	2	15	05:50	3	176	1	0	170	350	4	0	0
17	Lyon	06:30	2	17	04:40	2	270	3	1	390	280	4	0	0
18	Nantes	07:00	2	22	04:30	2	270	2	1	420	270	4	0	0
19	Paris	03:30	1	17	04:20	2	196	1	1	210	260	4	0	0
20	Rennes	06:20	2	17	04:30	2	242	2	1	380	270	4	0	0
21	Rouen	05:45	2	19	06:10	3	220	1	1	345	370	4	0	0
22	Troyes	06:00	2	19	06:20	3	198	1	1	360	380	4	0	0
23	Berlin	06:00	1	57	04:15	2	247	1	1	360	255	4	0	0
24	Bonn	03:00	1	25	04:40	3	228	1	0	180	280	4	0	0
25	Bremen	04:30	2	37	03:50	2	216	1	1	270	230	4	0	0

Figure 5.7: A screenshot of a database table containing travel information for some of the destinations

The travel mode suggestions were now ordered for each category. This results in the following list (number matches the categories described above):

1. Walking, bicycle, e-bike, public transport
2. Bicycle, e-bike, public transport, carpooling, private car
3. E-bike, public transport, carpooling, private car
4. Train, plane, carpooling, electric car, private car
5. Plane, carpooling, electric car, private car, train

Once a user enters a destination and clicks on 'continue' the application serves the above suggestions based on what category the destination falls in. If the destination has longitude and latitude information, this is used to calculate the distance from the location and determine the category, otherwise the pre-determined category applies (e.g. London falls in category 4, as it is labelled 'Always by train' in the Utrecht train zone map).

The result of this is shown in Figure 5.8. When the 'More +' button is clicked, information related to that mode is shown; in the context of the train, it provides a link to book a train ticket, for example.
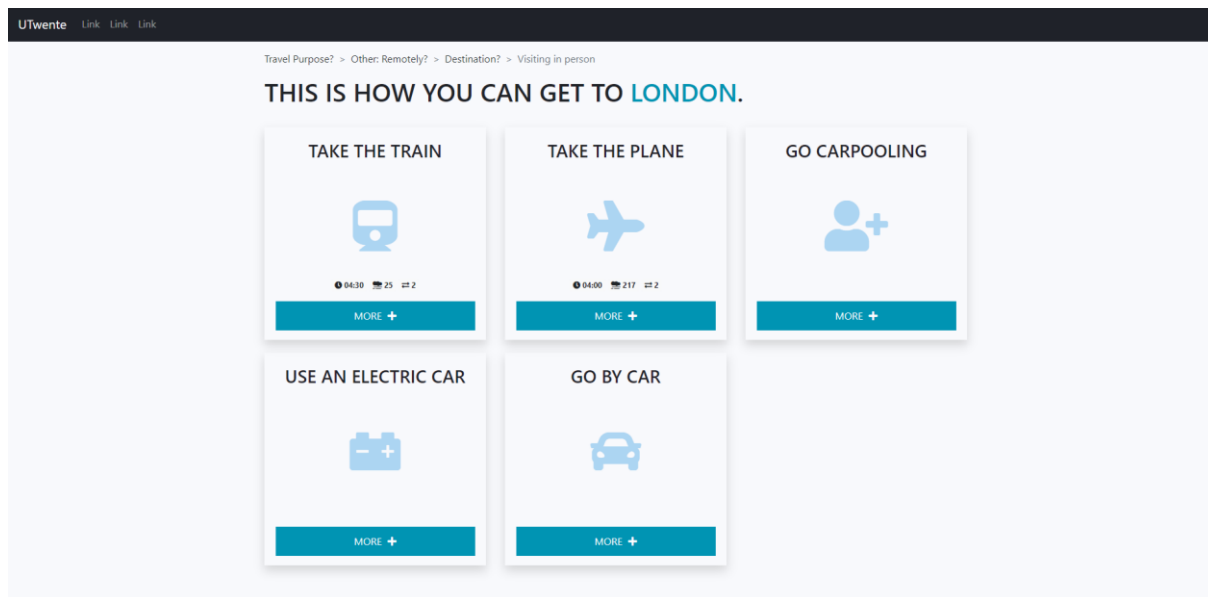
Figure 5.8: The travel suggestions for London

5.10 Iterations

Throughout the realization process, several iterations have been made. The major iterations worth mentioning are discussed here.

First of all, in section 5.1 the decision was made not to use WebHare. This choice was also discussed afterwards with the communication advisor in the sustainability department. They were strongly convinced that in order to really implement the travel check, it should be an actual part of the UT website and incorporated in the online staff environment. After discussing the options and difficulties, the decision was made to continue building the travel check outside of WebHare, and find out the possibilities later on.

Secondly, after discussing the first prototype of the application (Figure 5.1) and the decision tree (Figure 5.2), the client requested to make the application look 'flashy'. Based on this, the high-end sketches from section 5.6 were developed and ultimately picked as the base design of the web application.

Before inserting the train zone data, the travel check was tested with placeholder data that determined the travel category of the destination based on their distance to the location of the user. All the destinations thus had longitude and latitude information. After inserting the data from the train zone map in the database, some changes had to be made in the way the application categorized the destinations. How this turned out, can be read in section 5.9.

In the design, some changes have also been made throughout the process. Visible in the sketches from section 5.6 is the breadcrumb bar (the bar indicating at what page you are). This could not be achieved in the final prototype, as it was too difficult to create responsively (to the screen size). Therefore, a simple textual solution has been implemented. In Figure 5.9, the information about telecommuting is shown, with at the bottom an external link to the UT website. At first, this was also added inside a white containing box, but this looked off and after discussing the design with a fellow student, the decision was made to take it outside of the box and make it stand out in the background.
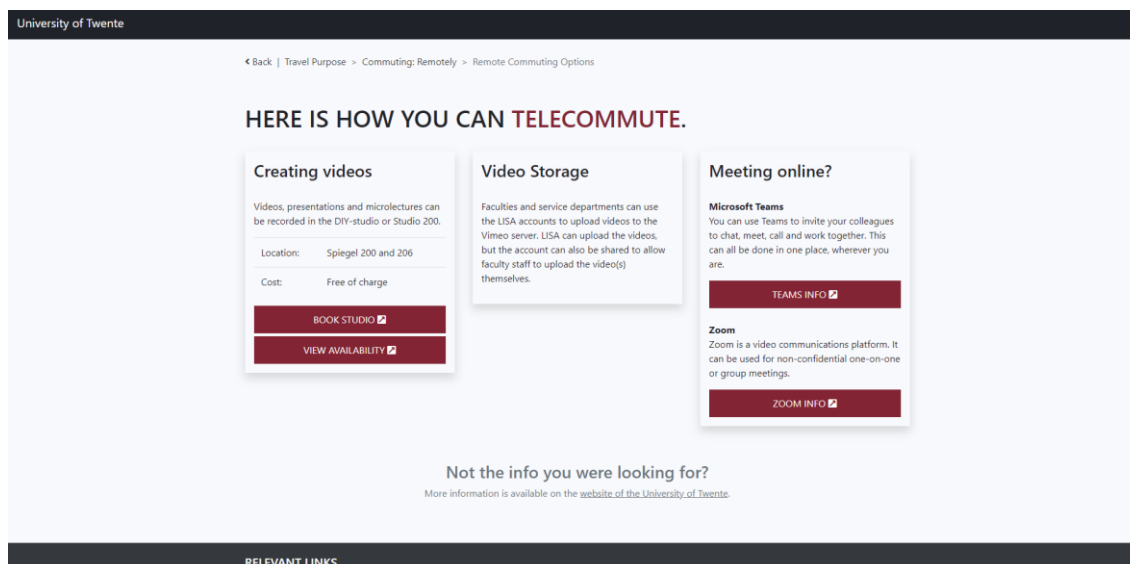
Figure 5.9: Screenshot of the telecommuting information

More information about the iterations during the realization phase can be read about in section 4.4.

5.11 Final Result
The prototype that was used for testing can be seen in Figure 5.9, 5.10 and 5.11. The result can be found on https://joshuavandermeer.nl/projects/travelcheck. Screenshots of all the pages are included in Appendix 5 and the code is included in Appendices 6 and 7.

In Figure 5.10, the 'Commuting' tile is filled with red, this partly shows what happens when one hovers over the tiles: an animation appears that fills the tile from bottom to top. Every time a new page is loaded, the new content also fades in to give the effect of a real page refresh. In the figures, it may also stand out that all the pages use different colors. Every time a new page shows up, the application picks a random color from the UT color palette and applies it to the elements on the page, resulting in a dynamic and playful look.
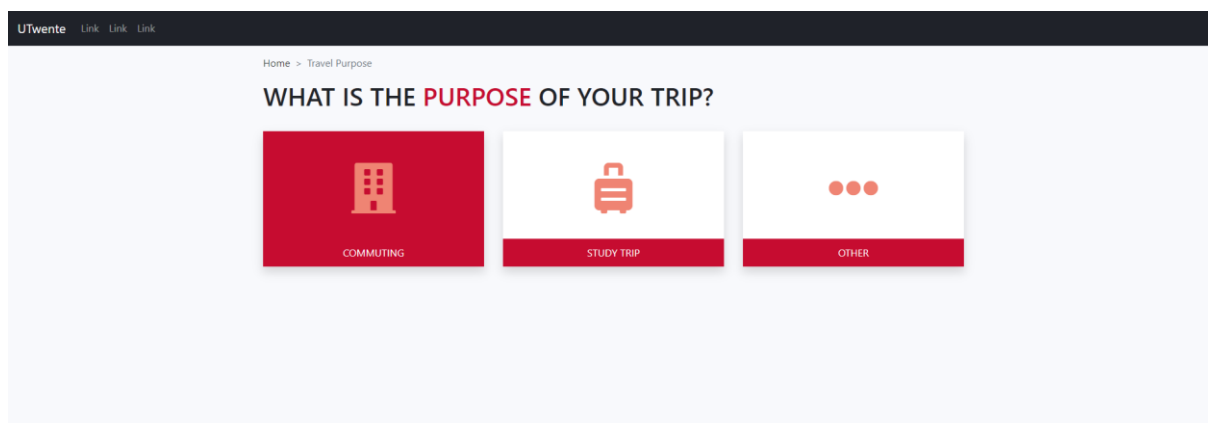

Figure 5.10: Screenshot of page asking for travel purpose

Figure 5.11: Screenshot of page asking for information for a study trip

6. Evaluation

In this chapter, the final prototype is evaluated through a functional test, a user test and a client evaluation. At the end of the chapter, the results are discussed and a list of suggestions and recommendations is provided.

6.1 Functional Test
In this section, the final prototype of the travel check is assessed by comparing the result to the requirements proposed in section 4.5. Additionally, the user scenarios from section 3.3 are compared to the final prototype to find out to what extent the initial concept matches the outcome.

6.1.1 Requirements Check
In Table 6.1, the final requirements from section 4.5 are displayed again, combined with an indication as to whether the requirement was fulfilled. A requirement could either be completely fulfilled (yes), partially fulfilled/fulfilled with a remark (yes, but), not fulfilled (no) or not fulfilled with a remark (no, but).

No.	Requirement	Category	Fulfilled?
1	Application must allow for user input (location, destination, date) and serve travel suggestions based on that.	Must	Yes
2	All possible travel options must be displayed and information about pros and cons and sustainability must be provided.	Must	Yes, but
3	The information from the train zone map must be incorporated in the application. Placeholder data can be used for the prototype.	Must	Yes
4	Supporting links related to discounts, grants and more information must be provided for each travel mode.	Must	Yes, but
5	The application should be responsive, in the sense that it can be used on all types of screens.	Must	Yes
6	The application should have an authentication system so that users can log in, track their activity and get an overview of their impact on sustainability.	Should	No
7	The application should clearly provide an overview of sustainability goals at the UT.	Should	Yes, but
8	The application should steer towards the most sustainable mode of travel in a given context, e.g. an electrical bicycle for distances of 10-15 kilometers. Comfortability and fewer transfers sometimes outweigh duration and distance.	Should	Yes
9	A database with articles regarding discounts, information about video conferencing, information about sustainability in general et cetera should be available in the travel check.	Should	No
10	Moderators should be able to edit and add content to the travel check.	Should	Yes

11	The data and activity of each interaction should be stored and monitored to gain insights in travel behavior.	Should	No
12	The application should fit in with the main UT website: same look and feel, but also same authentication system.	Should	No, but
13	The application should be fully secure.	Should	No, but
14	A promotion campaign could be developed to gain attention.	Could	No
15	Initiatives for team-based biking and interesting biking routes could be provided.	Could	No
16	A competitive system could be introduced that tracks and assigns 'sustainability-scores', allowing for sustainability-battles between individuals, studies and faculties.	Could	No
17	The travel check could serve information about the weather, delays in public transport and amount of traffic.	Could	No
18	Add feedback option in the application.	Could	No
19	The travel check could be built in WebHare, the CMS of the UT website.	Could	No
20	The application could be optimized for search engines.	Could	No
21	Points earned for sustainable choices will not yield a (financial) reward or compensation.	Will not	No
22	Sustainable incentives related to the travel check activity will not be included in job terms.	Will not	No
23	A connection could be made to the travel agency so that all travel activity can be booked instantly from the travel check application.	Will not	No
24	Staff could be awarded a periodical 'CO2-budget', which will be taken into consideration when making travel choices.	Will not	No

Table 6.1: Final requirements with an indication of whether the requirement was satisfied

From the functional analysis, a few conclusions can be made. All the 'Must Have'-requirements have been fulfilled, although two of these do not fully satisfy the requirement. For requirement 2, more information about pros, cons and sustainability of the different modes of travel could be added. The same applies for requirement 4, where a lot more links, data and information could be added to make the travel check more extensive. More information about the three requirements that were fulfilled (R1, R3, R5) can be found in sections 5.7 – 5.9, 5.7 & 5.9, and 5.1 respectively.

Within the 'Should Have'-category, three out of eight requirements were not fulfilled. The authentication system was not added (R6), since getting the UT-login integrated was not possible within the scope of this project. Indeed, a custom authentication system could have been set up, but the added benefit in this was not deemed valuable enough to outweigh the time it would take to implement and add extra functionalities to logged in users. Furthermore, a database with articles and information (R9) was not added since the data that could be in there was not collected and was not achievable for the final

prototype. However, implementing functionality to search for relevant information and articles would still be a good addition to the travel check. Finally, the interaction with the travel check (R11) was not stored mainly due to privacy concerns, in combination with the fact that due to a lack of integration with actual booking services, not much could have been be said about the effectiveness and results of the travel check prototype.

Requirements 12 and 13 were both classified as 'No, but'. For R12, this is mainly because the application was not built in WebHare (the CMS of the UT website, see section 5.1) which would ensure the UT-style of the application. Besides, the authentication system was not integrated. However, the application did take inspiration from the UT website and house style, which can be read about in section 5.6. Since the application did not build in any security measures, R13 was not satisfied. However, there is not much that can be 'attacked' or hacked, as the only data that is stored is information that can be found in the travel check anyhow. The connection to the database has been made as safely as possible, also preventing SQL injections. Therefore, the travel check is not unsecure, but rather not actively secured.

Requirement 7 is classified as 'yes, but', since the application does not actually provide information about the sustainability goals, but does link to the pages of the UT website that do. Therefore, the information can indirectly be found in the travel check. Requirements 8 and 10 were satisfied, as can be read about in sections 5.9 and 5.5 respectively.

None of the 'Could Have' and 'Will Not Have'-requirements were fulfilled. This was mainly because of time constraints, but all could turn out to be great improvements to the eventual application. The first one to address might be requirement 19 (building the application in WebHare), to ensure seamless integration in the services and appearance of the UT website.

6.1.2 User Scenarios Check
It is interesting to see how the initial ideas and visions of the travel check as described in the three user scenarios from section 3.3 would set out against the final result. In order to not have to read the full scenarios again, the relevant sentences have been put into Table 6.2 and assessed with a similar classification system as in Table 6.1.

Statement	User	Included?
When walking around on campus, a large billboard catches his eye. This billboard seems to be about some new UT-app, called Travel Check	Louis	No
While walking, Louis decides to look up the link … and uses his phone to go to the web application	Louis	Yes
On the homepage, he clicks a button that says "Take the travel check	Louis	No
Louis … gets asked for his travel purpose	Louis	Yes
He decided to select "Visit a lecture"	Louis	Yes, but
The webpage shows a list of possible (travel) options	Louis	Yes
… and an option to subscribe to a "Ride along"-function	Louis	No
The bicycle option on the webpage includes information on where he can get a bike, and also information and learning how to ride a bicycle	Louis	No, but
Louis selects the bicycle and gets all the information clearly visible on his screen	Louis	Yes
On top of that, some nice statistics are displayed about how much CO_2 emission could be spared if everyone would take the bike for distances < 15 kilometers	Louis	No
At the bottom of the page Louis sees information about signing up, including a button. "Sign up and compete with your friends to win prizes	Louis	No

Information is shown about points that can be earned by taking the bike.	Louis	No
She declares that she is an employee	Marielle	No
… selects a work trip as the purpose of her travel	Marielle	Yes, but
Now a question shows up that asks whether the trip could also be visited online	Marielle	Yes
However, she decides to select "Maybe" and a lot of possibilities to visit the meeting from home show up	Marielle	Yes
This also includes information about where conferencing equipment is present or can be taken home	Marielle	Yes, but
Marielle fires up the Travel Check again to gather the information about video conferencing,	Marielle	Yes
… picks up the equipment from the specified location	Marielle	Yes, but
… and watches a workshop video on how to use the equipment	Marielle	No
All travel must now be booked through the travel agency in order to collect as much data as possible.	Johan	No
The travel agency has been requested to always provide the most sustainable and fitting travel option first	Johan	No
Whenever Johan gets a request to book a trip, this request always includes the date, the departure place, the destination and the purpose of the trip	Johan	No, but
… along with details about the person and preferences that the user could specify upon placing the request.	Johan	No
Johan goes through the travel check and gets recommended the best suitable and sustainable travel option	Johan	Yes
The selected mode of travel can easily be booked, however, a confirmation from the user is needed first	Johan	No
Johan books it and stores the trip in the database using a single button click on the travel check application	Johan	No

Table 6.2: Comparison of statements in user scenarios and final prototype

Similar to the results from section 6.1.1, only a little bit more than a third of the statements ended up actually being in the final prototype for the travel check. Especially the user scenario of Johan did not satisfy, since no connection to the ITC Travel Agency was made in any way; the use scenario of Johan is not applicable to the final prototype of the travel check. For the main target of the project, secretary Marielle, most of the envisioned functionalities were present. Just like Louis, Marielle was not able to declare her role (student/staff) at the start of the travel check. The information about renting equipment is only partly available, or indirectly through another external link to the UT website. It is, however, uncertain whether it is actually possible to rent and pick up remote conferencing material.

For Louis, the most important parts were integrated in the final prototype. However, a promotion campaign has not been set up (no billboard), there is no home or landing page yet (instantly opens up the first question), Ride Along functionality has not been included (could be later on, is developed by a third party), statistics about sustainability are not shown, sign-up button not present, and competition, point earning & prizes are not included. These would still be interesting additions, as it could spark interest and increase reusability of the travel check. However, these were not possible to achieve in the scope of this project.

In all, the comparison between the user scenarios and the final prototype shows that most of the important functions have been included, but noticeably the connection to ITC and the advanced functionalities are missing.

6.2 User Test

6.2.1 Setup and Details

Between June 17 and 23, the final prototype of the travel check was open for user testing. This user test consisted of an online questionnaire with a link to the travel check application. In the first section, participants were asked to navigate to the travel check in a separate tab, and execute the tasks depicted on the questionnaire. To check whether the participants were able to successfully execute the tasks, questions were asked about the information that should have been found in the task. In the second section, some general questions about the look and feel of the travel check were asked. The third section included ten questions from the System Usability Scale (SUS), which is explained in the next section.

At the start of the questionnaire, participants were informed about the research and asked for consent. Through the client, Brechje Marechal, the user test was spread by email to members of teams such as SEG Sustainability, SEE (Sustainability, Energy & Environment), Health & Safety and Green Hub, as well as various secretariats. A total of 20 (65% female, 25% male, 10% other) respondents was achieved, with an average age of 46.9 years old. Most of the respondents were from the Netherlands (75%), while one participant did not want to state their nationality. The remaining four nationalities were German, South-African, English and a combination of English and Dutch. A large majority (90%) of the respondents used a desktop to participate, while one respondent used a tablet and yet another a laptop.

6.2.2 Task Execution

The participants were asked to execute three tasks and answer questions about these accordingly. The first task instructed the respondent to find out how one can get to Edinburgh. The respondents were then asked how long it would take them to get to Edinburgh by train, which is information that can be found in the travel check by selecting 'Other' as travel purpose and then claiming that you have to go in person. In the following page, the respondent would need to enter the destination (Edinburgh) in the search box and click continue. The resulting page would show information and details about the recommended travel modes. The respondents seemed to be able to easily find this information, as 85% of the respondents answered correctly.

The second task put the respondents in the shoes of a professor: 'Suppose you are a professor that wants to record a microlecture. How much does it cost to record a lecture?' This information could be found by selecting 'Commuting' as the travel purpose and then stating that this could be done from home. The resulting page gives information about all types of telecommuting options. Again, the respondents did not seem to troubled too much: 85% answered correctly, while 10% seemed to have misinterpreted the question as they answered "creating videos" or "3 hours." One participant stated that recording a lecture is not really a travel purpose.

Finally, the third task required the participants to find information about the sustainability goals at the UT. Two questions were asked, 'How much CO2 reduction does the UT want to achieve by 2023 compared to 2020?' and 'How much does mobility contribute to the current CO2 footprint?' The answers to these questions could be found in the external links (Carbon Footprint and Mobility) in the footer of the application (Figure 6.1). The first question appeared to be quite easy: 90% of respondents answered correctly. For the second question, two answers could be provided. The carbon footprint that was linked would show a percentage of 15% caused by mobility (2020), whilst in the textual description on the mobility page, a percentage of 31% was mentioned (based on the carbon footprint of 2019). Nearly all users (95%) were able to find either of these answers.
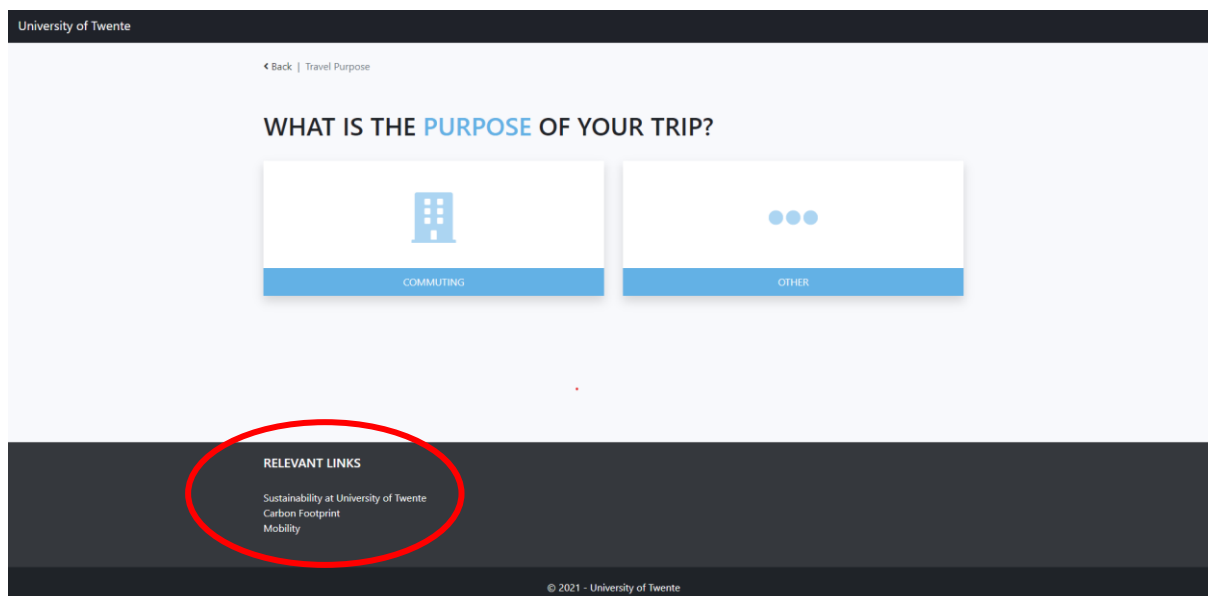
Figure 6.1: For the third task, respondents had to gather the information by clicking the relevant links in the footer

The users were then asked how difficult they thought the tasks were, on a five point Likert-scale ranging from 'very difficult' (1) to 'very easy' (5). On average, the respondents believed the tasks to be rather easy (3.95). Task 3 was perceived as the most difficult one (80%), followed by task 1 (15%) and task 2 (5%). The respondents that indicated that task 3 was the most difficult, mentioned the following reasons: Difficult to find (11x), takes too long (3x) and had to read through too much information (3x). For task 1, two users were confused as to what the provided times meant: would it include transfer time and travel time from home to station? One of these users even seemed to have made their own estimate of the travel time to Edinburgh in the question for task 1. The third user that thought task 1 was the most difficult, stated that the task was not complete, and that they would have picked task 3 otherwise. It is unclear what is meant by this, but it could refer to the fact that there was a mistake in the questionnaire at the moment it was sent out. However, this mistake was quickly fixed after getting notified by email. Finally, the respondent that mentioned in task 2 that recording a lecture is not a travel purpose, stated that task 2 was the most difficult as they were not able to find the information.

6.2.3 System Usability Scale (SUS)
One way to assess the usability of a system is by using the System Usability Scale (SUS): "A simple, ten-item scale giving a global view of subjective assessments of usability" [29, p. 3]. The ten questions from the SUS "cover a variety of aspects of system usability, such as the need for support, training, and complexity, and thus have a high level of face validity for measuring usability of a system" [29, p. 3].

After calculating the scores and averaging these across the participants, a final SUS score of 76.25 was found. This can be classified as 'good', as "a SUS score above a 68 would be considered above average" [30]. From an individual level, 70% of respondents indicated a SUS-score higher than 68, with the highest score being 95. The lowest individual SUS-score found was 37.5.

Apart from the general SUS score, several conclusions can be drawn based on the various questions and their results. First of all, it stands out that the first question, 'I think that I would like to use this system frequently,' scores the lowest, with an average score of 3.1 (Figure 6.2). Most people (n=7) pick option 3, which can be interpreted as 'neutral.'

I think that I would like to use this system frequently.
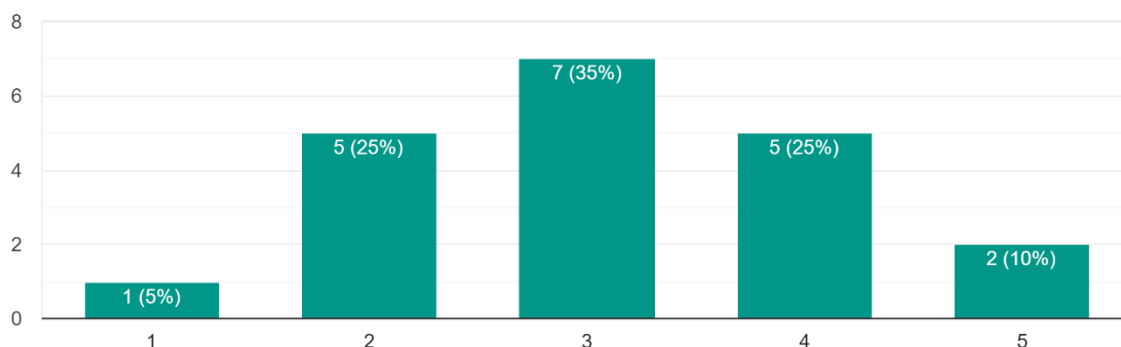20 responses

Figure 6.2: Bar chart showing responses to the statement 'I think that I would like to use this system frequently' (1 = strongly disagree, 5 = strongly agree)

Furthermore, all the participants seemingly felt the same about the statement 'I think that I would need the support of a technical person to be able to use this system.' Five people disagree, whereas the remaining fifteen participants all strongly disagree. This indicates that the system was not too difficult to use.

6.2.4 Effectiveness

Even though the travel check could not really be tested for its effectiveness or the extent to which it is able to make people change their mind about what travel mode they will use to get to a certain destination, two questions were included to get a slight indication of the performance of the travel check. In the first task (train to Edinburgh), the respondents were asked what travel mode they would have picked prior to seeing the results in the travel check (Figure 6.3). A large majority (90%) indicated that they would take the plane, whilst the remaining 10% would go by train.

What travel mode would you have chosen prior to using the travel check?
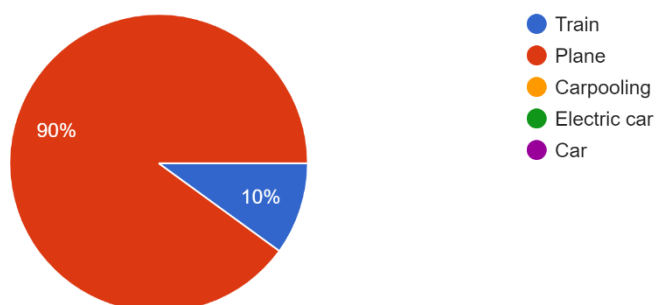20 responses

Figure 6.3: Pie chart indicating the preferred travel mode to Edinburgh prior to using the travel check

However, after having seen the options that the travel check provided, this majority decreased to 60% (Figure 6.4). Now, 35% of the respondents claim they would go by train, and another 5% would have taken the electric car.

Which travel mode would you personally use after seeing the travel options?
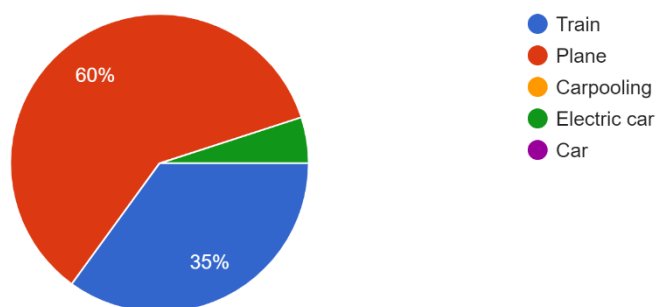20 responses

- Train
- Plane
- Carpooling
- Electric car
- Car

60%

35%

Figure 6.4: Pie chart indicating the preferred travel mode to Edinburgh after using the travel check

6.2.5 Impression and Feedback

After having used the travel check, the respondents were asked about their experience. When asked about their overall impression, various positive impressions were mentioned: Easy to use (5x), helpful/useful (5x), nice/good (4x), looks good (2x), nice guidance, good awareness of CO2, clear, simple, and informative. Some people noticed that something was missing; the amount of destinations that could be selected was limited, for instance. Besides, one user again mentioned that the travel times could be clarified by adding some more information. One person believes that the first question is a bit redundant, as people "have already considered that before planning a trip." It is unclear whether they refer to the question about the travel purpose (the first question) or the question whether the activity could be attended remotely (the second question), but it seems more likely that they refer to the latter. Two people were a bit negative, as one believed the travel check is not useful, whereas the other perceived the travel suggestions to be similar to parental control (and thus a bit immature).

Using the same five point Likert-scale again, the respondents were asked about the navigation within the travel check (Figure 6.5) and the presentation of the information. Most of the respondents (90%) either agreed or strongly agreed with the statement that the travel check was easy to navigate. The other two respondents were neutral or disagreed, resulting in an average score of 4.15 (agree). Similar results were observed for the statement 'the presented information was clear and easy to take in': 80% agreed or strongly agreed, while only two respondents (10%) disagreed. The remaining 10% were neutral, resulting in an average score of 4 (agree).

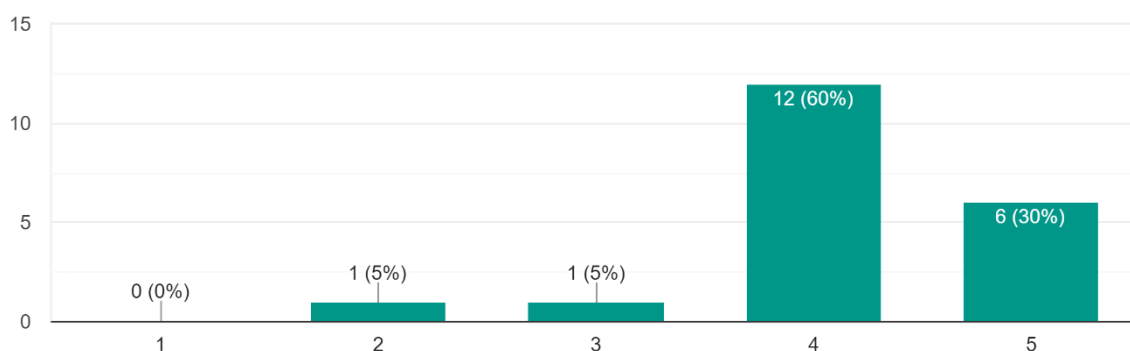The travel check was easy to navigate
20 responses

Figure 6.5: Bar chart showing the perceived ease of the navigation in the travel check (1 = strongly disagree, 5 = strongly agree)

When asked whether anything was surprising or unexpected, one user mentioned that they attempted to enter five destinations before the application finally recognized one. Another participant rightly pointed out that the CO2 emissions for the travel modes did not indicate in what unit the CO2 was measured. One user mentioned that it seems a bit simple, but also indicated that this could be a good thing. Finally, one respondent was surprised there was no information about travelling by car.

To the question what would keep people from using the application, various reasons were mentioned. Two respondents state that it should not be difficult to find, or hidden behind multiple links or passwords. Moreover, it is once again stated by three participants that the travel check should not be an extra step in the booking process, but rather an integrated part. Additionally, time consumption (2x), predictability, laziness, and personal preferences (for instance, a user that prefers to always travel by car) were mentioned. One respondent believed the information was incorrect: they claimed a trip to Edinburgh by train would take much more time than the 11 hours mentioned on the travel check.

Three respondents indicate that they expect that the travel check helps them gain awareness about CO2 emissions. Additionally, five participants believe that the travel check is helpful in providing a clear overview of the various travel modes that can be used to get to a certain destination. Besides, respondents expected quick trip advice, indication of where tickets can be booked, information, clarity and saving of time. On the other hand, two respondents stated that they expected little to nothing from the application, and one emphasized that the application should reduce the amount of work, and not be an extra step.

When asked about the design of the travel check, four respondents stated that it was easy and natural in use. In addition, the respondents praised the clarity (4x), the simplicity (3x), the big buttons (2x), the clear overview of the travel modes (2x), the colors, the speed with which it can be completed, and the use of icons. However, respondents critiqued the (limited) amount of destinations available. One respondent repeated that the first question (either about travel purpose or about whether their work can be done remotely) was holding them up. Furthermore, one respondent pointed out that they were not able to combine travel modes, for instance going carpooling with an electric car. Interestingly enough, 50% of the respondents did not mention what they disliked most about the design, some claiming it was just alright.

Finally, the respondents were asked whether they had any final tips or remarks. One respondent recommended to include all time durations and possibly costs to enable the user to make an informed decision. Another respondent suggested that the UT could get their own electric cars to allow for carpooling to conferences. A final suggestion was to add an approval step, which could then be given by the secretary that is in charge of the flight arranging.

6.2.6 Feedback by Email
Some people decided not to participate in the user test, but had a look at the travel check separately and provided some feedback through email. Most feedback corresponded with the feedback received in the user test. Again, people praised the user-friendliness, usefulness, design and the initiative in itself. Two people even offered to help finding more participants, and one proposed to brainstorm together to work it out further. Another claimed that it could be beneficial to not only the UT, but also to the ECIU (European Consortium of Innovative Universities) [31].

There were also uncertainties; two people doubted that it would be used frequently as in the end time is money, making travel by plane the most attractive option. The perceived need of a scientist or professor of being physically present at a conference was also mentioned as possibly detrimental to the success of the travel check. Finally, one user stated that in order to succeed, the travel check should be a complete travel planner with all modalities and options (e.g. time, costs, connections, sustainability).

6.3 Client Evaluation
At the end of the project, the final prototype of the travel check was evaluated with the client. First, they were asked about the overall impression of the travel check. They claimed that it looked good, but

noticed that the question 'Do you really have to go in person' did not have any incentive to press the 'Perhaps not…'-button. She wondered whether this would be enough to actually make people think about the need to go in person. It was recommended to actively incentivize people in this step, for instance by giving examples of situations in which it would be better to attend remotely.

To the question whether the application was clear enough to use, she nodded. However, there were some things that did not have information or relevant links (for example, travel by car did not have any travel information or articles). Additionally, the small information about travel duration and CO_2-emission could be improved by using visual indicators, colored bars for example, as visually impaired people would have more difficulty reading and interpreting the small letters. Moreover, more information should be provided as to what constitutes the different travel times: A flight to Edinburgh does not take 4.5 hours, but the combined total of getting to the airport, checking in, security check, onboarding et cetera, does. This should be set out in the travel check itself, or include a reference to an article that describes how much extra time flying takes. A similar addition could be made for train travel, where it could be indicated that travelling by train is much more comfortable and (better) allows for working during the trip. A link to an article that describes the advantages of travelling by train would be sufficient.

The content was very clear and provided a good overview of the different options. More content should be added to the different travel modes. Unsustainable travel modes, such as using the car, should be discouraged someway. This could be achieved by linking a critical article about how, for instance, business travel by car is not a suitable way of travelling. In the end, the goal remains to get people to use sustainable travel modes, so a little bit of steering towards that goal is allowed. However, it is interesting to think about the extent to which the travel check is being pedantic and limiting.

The biggest strength of the travel check is the completeness: It shows all the options next to each other, ranging from train to an electric car. Furthermore, the travel check provides a very clean overview and the fact that it is a website makes it easily accessible and easy to use for anyone. Some small remarks were made: the official logo of the UT should be used, and the colors could maybe be changed to tints of green (hinting towards sustainability).

The client confirmed that the travel check met their expectations. However, the next step was to think about the future, and what would be needed to actually implement this product at the UT. A connection should be made with the train zone map that is being developed by Saxion students. Besides, people should be able to select a starting destination as this makes a difference with regards to travel durations.

6.4 Discussion
Before drawing conclusions from the evaluation, a few remarks should be made. First of all, the amount of respondents (n=20) does not lead to statistically significant results. Besides, apart from the SUS score, no scientific results can be attached to the outcomes of the user test; the results primarily give an indication of strengths and weaknesses of the travel check and should be treated as mere feedback. The results in section 6.2.4 do not give an accurate view of how the travel check would impact travel behavior when users are actually going to travel; this should be tested in a later stage of the project. Furthermore, 95% of the respondents used their pc to do the user test, which means that not much can be said about the extent to which the travel check works successfully and satisfactory on another device. Again, this could be tested in a later stage where respondents are divided in groups that all use a different type of device.

The tasks that the users were presented with have given a good impression of the strengths and weaknesses of the travel check. The sustainability goals at the UT should be incorporated directly into the travel check, without the need to skim through large amounts of text. Besides, more information should be provided about travel times, for instance by outlining exactly what part of the trip takes what amount of time. The respondent that was not able to find the costs for recording a lecture made a fair point: recording a lecture is not really telecommuting, as you still have to go to the campus. This should thus be framed in a different way, or the information should be provided separately from the decision tree.

The low score on the question whether users would frequently use the travel check can be explained by the fact that the prototype lacked any functionality or features to make people return: In order to increase this score, the travel check could, for instance, be an integrated part of the booking process.

Since all the respondents either disagree or strongly disagree that they would need the help of a technical person to use the application, it can be stated that people feel comfortable using the application and that it is easy to use. Additionally, both the navigation and the information presentation were perceived as good.

The SUS-score suggests that the usability of the travel check is good. An important area to improve on is the reusability of the application, to ensure that people come back to the application whenever they need to travel.

The user test showed that after consulting the travel check, 35% respondents would go to Edinburgh by train (initially 10%). Admittedly, these results are not statistically significant or even a reliable indication of the effectiveness of the travel check, since the respondents do not actually have to travel by the mode they selected. However, it does give an impression of what the provision of information does to change the preferred travel mode of the respondents.

A lot of suggestions and recommendations were noted based on all the feedback from the people who participated in the user test, people who emailed their feedback and the client. The following list gives an overview of these suggestions and recommendations:

- The unit for CO_2 was not added; this is, in fact, in kilograms and should be presented next to the information.
- Some information is missing, for example for planes and cars. This was indeed not added for the final prototype, but should be included when developing the actual application.
- The travel durations should be explained and set out to give a better overview of what takes up what amount of time.
- The starting destination should be taken into account when showing the travel durations. This would definitely improve the presented information, but would require a lot more data or integration with a travel service.
- The travel check should be an integrated part of the booking process, not an extra step. This could be achieved by ensuring that the choice you end up with in the travel check can be transferred to the actual booking process (e.g. if you select the train to go to London, a link you click will take your inserted departure date and starting point to another website and automatically provide you with the actual ticket options).
- It should be possible to combine travel modes, for example when you want to go carpooling to the airport.
- The travel check could be worked out to be a complete travel planner, complete with all travel modes and information. This should be considered when developing the actual implementation of the travel check.
- There should be more focus on incentivizing people to work remotely. A question alone might not be enough; provide examples of situations you can do your work remotely instead. This would make people more inclined to actually think about their situation and whether they actually need to travel.
- The small letters that provide information about travel time, CO_2 emission and amount of transfers could be changed to visual elements. This would improve the usability and user experience (in particular for people with decreased eyesight) and would be a good update.
- The application should steer towards sustainable travel modes more. Travelling by car, for example, should be discouraged by visual elements and discouraging articles and information.

7. Conclusion & Discussion

The goal of this research was to find an answer to the question how a travel check should be designed to increase sustainable travel at the UT. In this chapter, answers are provided to the sub questions and ultimately to the main research question. Subsequently, a small discussion describes some of the limitations of the research.

In this research, a travel check has been designed in the form of an interactive web application. Prior to the research, a main research question had been established along with three sub questions. First, these sub questions are answered.

The first question *'How can the usage of sustainable travel modes be incentivized?'* was mostly addressed in chapter 2. Here, seven recommendations were found that could incentivize users to use sustainable travel modes:

1. Initiate carpooling
2. Offer discounts for (e-)bike renting and leasing
3. Provide information on pros and cons, prices and sustainability of each travel mode, as well as general information about the importance of sustainability.
4. Stimulate telecommuting by providing online or pre-recorded lectures and supporting online peer meetings.
5. Rewards or compensation: by giving (financial) rewards, application users will be more likely to choose sustainably.
6. Target unsustainable groups by monitoring travel data and collaboration with other travel services.
7. Initiate team-based biking.

Recommendation 1-5 were regarded as the most important for the travel check at the UT. However, in the scope of this research it was not possible to add actual monetary rewards or discounts to the travel check, nor was it possible to add a carpooling platform to the travel check as it is currently under development. For recommendation 6, the intention was to collect all the interaction with the travel check, but due to privacy concerns this was abandoned. Besides, a connection of this interaction data and actual travel data would be needed to actually gain insights into the effectiveness of the travel check. Given the situation in the Netherlands, where most people commute by bicycle already, the suggestion of team-based biking was deemed of reduced importance and left out of consideration for this project.

The second question *'What kind of information should be included in a travel check?'* is partly answered by the aforementioned seven recommendations. Indeed, recommendation 2 shows an important part of the information that should be included. Additionally, discussions with the client and the user test evaluation led to a more extensive answer to the second question. The following information is recommended to be included in a travel check:

1. Travel costs
2. Travel duration (including an overview of what parts of the trip take what amount of time)
3. Estimated CO_2 emission in kilogram
4. Video conferencing equipment and possibilities
5. Train Zone Map showing the frequently visited destinations and details
6. Sustainability goals at the university
7. Database with articles surrounding sustainability
8. (Research) articles encouraging sustainable travel or remote visiting
9. Discounts and subsidies

Most of these have to do with the provision of information, which helps the user in making a conscious and informed decision. Feedback from the user test suggested that for many people it is important to see exactly what the total travel duration consists of. Additionally, the costs and CO2 emissions allow for a

quick comparison and consideration. The sustainability goals should be clearly present within the application itself, and not referred to by an external link.

Finally, the question *'What should a travel check have to offer to make users return?'* is answered. The user test showed that people were not expecting to use the travel check frequently. One respondent claimed that it would become predictable (e.g. taking the train is always more sustainable than taking a flight). Therefore, it is important that the travel check offers something unique that makes people want to return. Otherwise, the result could for instance be that people go back to booking a flight without actually considering taking the train.

In order to achieve this, an important step could be to turn the travel check into a full scale travel planner. This would make the travel check attractive to the users, as they do not have to go over all the different possibilities and different travel services, but are able to find all the options in one application. This solution is described in more detail in the following chapter, Future Work. In case that the previous suggestion is too far fetched, the next best thing would be to provide as much, as accurate and as user-focused information as possible. If a user feels that the application is taking their situation into account (travel purpose, departure destination, preferences, destination, et cetera), the expectation is that they are more inclined to return as it will provide a more personal experience.

Having answered the three sub questions, an answer can now be formulated to the main research question. For clarity, the research question was worded as follows:

- *How should a travel check be designed to increase sustainable travel at the UT?*

The difficulty of this question lies in the final part: One can create a travel check quite easily, but ensuring that people actually start travelling more sustainably after consulting this travel check is a lot harder to achieve. Based on the research and evaluation of the travel check created, it appears that the most important aspect of convincing people to travel sustainably through a travel check is the provision of information. If a quick comparison between travelling by train and travelling by plane shows that it will only take a little bit longer to go by train, while sparing costs and causing just a fraction of the amount of CO_2 emission of that of a plane, a sustainable decision is quickly made. Since the travel check allows people to quickly compare and make and informed and conscious decision, it might be of crucial importance that the travel check has something to offer that makes people return each time they travel.

In conclusion, a travel check should be interactive (taking an individual's situation into account), as well as have something unique to offer. The travel check that was designed in this research offers a lot of opportunities to expand upon, and could serve as a starting point for future implementations.

8. Future Work

Based on the evaluation and the prior research into the topic, a lot of recommendations can be made to improve the travel check. First, two major recommendations are discussed, after which some smaller recommendations are made.

First of all, to maximize the effect of the travel check, it should be integrated in the booking process. This could be achieved in two ways. Either, it could be made mandatory whenever you want to book travel through the UT, for example by only reimbursing the travel costs if the person can prove they took the travel check first. Or, the travel check can be made optional but serve as a useful tool, such that users are willing to take it because it gets them useful information and a quick booking process. This can be done by ensuring that the results from the travel check can be transferred to the actual booking service. This way, a lot of time and struggle can be spared (e.g. if you select that you want to go to London by train, you click a link that will take you to the booking page and fills in the information you already provided in the travel check automatically).

This also connects to the second recommendation: travel services and planners should be integrated. This way, accurate information can be provided (for example duration, available tickets, departure and arrival data) and people are able to quickly book the travel mode of their choice. Indeed, there are a lot of travel services around, making it harder to integrate all services. However, it is recommended to start by integrating the services of NS International, as staff at the UT already is able to travel with the NS business card. If travel services could be integrated, the travel check would need to ask for a little more information from the user (e.g. departure date, travel preferences).

Furthermore, an important aspect of the travel check seems to be the provision of information. Therefore, a lot more information should be added to the travel check. This information could be a clearer overview of travel times and what part of the trip takes what amount of time, but also more information on why you should travel sustainably and advantages of the various sustainable modes (for instance, explaining that it is easier to work in the train than in the plane). The information from the train zone map for Enschede (that is being developed at Saxion) should be included in the application, especially when integration with travel services has not been achieved.

It is also important to think about the integration of the travel check into the UT website. As was already discussed with the communication advisor, it could be of major importance that the travel check fits in with the rest of the services and the look of the UT website. It should be explored what the opportunities are to build the application within WebHare, but if this would not allow for custom programming, the consideration should be made whether the travel check should be built in WebHare in a simplified form, or that a method should be found that ensures that the travel check is hosted on the UT website, fits within the overall style of the website but is still programmed separately from WebHare.

Finally, some user testing should be done on finding out to what extent the application can push people towards sustainable modes. Some people might get irritated or give up using the travel check because they feel being limited or that the travel check is being too pedantic. Therefore, it would be useful to set up user tests for people who are actually going to travel, with different versions of the travel check. These versions would then differ in the intensity of pushing the user towards sustainable modes. This would require quite a lot of participants and a long testing period, so it would be important to make sure that the travel check is fully worked out and contains all the necessary functions and information.

References

[1]   University of Twente, "Carbon footprint | Sustainability on campus," *Universiteit Twente*. https://www.utwente.nl/en/sustainability/carbon-footprint/ (accessed Feb. 13, 2021).

[2]   University of Twente, "Initiatives | Mobility | Sustainability on campus," *Universiteit Twente*. https://www.utwente.nl/en/sustainability/initiatives/mobility/ (accessed Feb. 13, 2021).

[3]   Universiteit Utrecht, "Travel Check," *uu.nl*. https://www.uu.nl/sites/default/files/uu_-_travel_check_en.pdf (accessed Apr. 15, 2021).

[4]   A. Khan, M. Mohammadzadeh, and A. Syam, "A travel plan as a tool for modifying university staff and students' travel behaviour towards sustainable practices," *Urban Transport XX*, May 2014, doi: 10.2495/ut140061.

[5]   J. Zhou, "Sustainable commute in a car-dominant city: Factors affecting alternative mode choices among university students," *Transportation Research Part A: Policy and Practice*, vol. 46, no. 7, pp. 1013–1029, Aug. 2012, doi: 10.1016/j.tra.2012.04.001.

[6]   M. K. Devi, "Potential to increase active commuting level in university area (Case study: Universitas Gadjah Mada)," *IOP Conference Series: Earth and Environmental Science*, vol. 70, p. 012022, Jun. 2017, doi: 10.1088/1755-1315/70/1/012022.

[7]   R. J. Sargisson, "Do parking fees affect commuting choices of staff and students on a university campus?," *International Journal of Transport Development and Integration*, vol. 2, no. 2, pp. 189–201, Jan. 2017, doi: 10.2495/tdi-v2-n2-189-201.

[8]   P. A. Plazier, G. Weitkamp, and A. E. van den Berg, "The potential for e-biking among the younger population: A study of Dutch students," *Travel Behaviour and Society*, vol. 8, pp. 37–45, Jul. 2017, doi: 10.1016/j.tbs.2017.04.007.

[9]   B. Gatersleben and D. Uzzell, "Affective Appraisals of the Daily Commute," *Environment and Behavior*, vol. 39, no. 3, pp. 416–431, May 2007, doi: 10.1177/0013916506294032.

[10]   J. Zhou, "Proactive sustainable university transportation: Marginal effects, intrinsic values, and university students' mode choice," *International Journal of Sustainable Transportation*, vol. 10, no. 9, pp. 815–824, Mar. 2016, doi: 10.1080/15568318.2016.1159357.

[11]   M. K. Nematchoua, C. Deuse, M. Cools, and S. Reiter, "Evaluation of the potential of classic and electric bicycle commuting as an impetus for the transition towards environmentally sustainable cities: a case study of the university campuses in Liege, Belgium,." Accessed: Mar. 22, 2021. [Online]. Available: https://orbi.uliege.be/bitstream/2268/242413/1/Revised-article%20%28final%29-converti.pdf.

[12]   G. Bösehans and I. Walker, "Do supra-modal traveller types exist? A travel behaviour market segmentation using Goal framing theory," *Transportation*, Apr. 2018, doi: 10.1007/s11116-   018-9874-7.

[13]   Universiteit Utrecht, "The Train Zone Map," *uu.nl*. https://www.uu.nl/sites/default/files/trainzonemap-en-v2.pdf (accessed Apr. 15, 2021).

[14]   Wageningen University & Research, *WUR Travel Check*. Mar. 03, 2020.

[15]   "Projects," *University of Groningen*, Jan. 27, 2020. https://www.rug.nl/about-ug/profile/facts-and-figures/duurzaamheid/projecten?lang=en (accessed Jul. 03, 2021).

[16]   R. K. Mitchell, B. R. Agle, and D. J. Wood, "Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts," *The Academy of Management Review*, vol. 22, no. 4, pp. 853–886, Oct. 1997, doi: 10.2307/259247.

[17] H. Sharp, A. Finkelstein, and G. Galal, "Stakeholder identification in the requirements engineering process," *Proceedings. Tenth International Workshop on Database and Expert Systems Applications. DEXA 99*, 1999, doi: 10.1109/dexa.1999.795198.

[18] C. Eden and F. Ackermann, "Making Strategy: The Journey of Strategic Management," 1998, doi: 10.4135/9781446217153.

[19] "NS Business Card | NS Business Card Overview | Human Resources," *Universiteit Twente*. https://www.utwente.nl/en/hr/terms-of-employment/business-travel/ns-bc/ (accessed Jul. 04, 2021).

[20] K. S. Ahmad, N. Ahmad, H. Tahir, and S. Khan, "Fuzzy_MoSCoW: A fuzzy based MoSCoW method for the prioritization of software requirements," *2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT)*, Jul. 2017, doi: 10.1109/icicict1.2017.8342602.

[21] "WebHare: CMS, E-commerce & Online Marketing Platform," *WebHare bv*. https://www.webhare.nl/ (accessed Jun. 15, 2021).

[22] "Fietsmaatjes," *Twente Mobiel*. https://www.twentemobiel.nl/fietsmaatjes/ (accessed Jun. 15, 2021).

[23] M. Otto, "Bootstrap," *Getbootstrap.com*, 2000. https://getbootstrap.com/.

[24] T. Otwell, "Laravel - The PHP Framework For Web Artisans," *Laravel.com*, 2015. https://laravel.com/.

[25] "WordPress.com: Create a Free Website or Blog," *WordPress.com*. https://wordpress.com/en/ (accessed Jun. 15, 2021).

[26] "Use pound sign or hash mark in click-through - Studio Help," *support.google.com*. https://support.google.com/richmedia/answer/190941/use-pound-sign-or-hash-mark-in-click-through?hl=en#:~:text=In%20a%20URL%2C%20a%20hash (accessed Jun. 15, 2021).

[27] "House style | Templates and downloads | Organisation," *Universiteit Twente*. https://www.utwente.nl/en/organisation/house-style/templates-and-downloads/ (accessed Jun. 15, 2021).

[28] B. Marechal, "Sustainable Mobility Plan 2021-2030," Apr. 09, 2021.

[29] J. Brooke, "SUS -A quick and dirty usability scale Usability and context,." Accessed: Jul. 01, 2021. [Online]. Available: https://liacs.leidenuniv.nl/~verbeekfj/courses/hci/SUS-questionaire.pdf.

[30] "System Usability Scale (SUS) | Usability.gov," *Usability.gov*, 2019. https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html.

[31] "ECIU - The European Consortium of Innovative Universities," *www.eciu.org*. https://www.eciu.org/ (accessed Jun. 30, 2021).

Appendix 1: Questionnaire

Interactive Travel Check – User Test

In this user test you will be testing out a web application that functions as an interactive travel check. This so-called travel check informs you about what travel modes are available to travel to a certain destination, and helps you decide which mode to pick. This questionnaire will provide you with some tasks and asks you to reflect on these tasks and the experience in general.

* Required

Information Brochure

The goal of this user test is to find out if the travel check application works as intended, what areas need improvement and how the user experience is perceived.

You will be asked to perform a couple of tasks, answer some questions and reflect on the experience. The research will take around 10 minutes.

This research has been approved by the EEMCS ethics committee. Please note that you can withdraw from the study at any time before July 7, 2021. You can do this by informing the researcher(s) (contact information below) that you do not wish to participate any longer, or that your answer cannot be taken into account. Your personal information will not be included in this study, only the answers to the questions will be used and published in anonymized form. Your age, gender and nationality will be anonymized. All raw data will also be deleted once research has been concluded and only be retained in anonymized form.

If you have any questions, please contact Joshua van der Meer (j.vandermeer@student.utwente.nl), dr. J. Zwiers or ir.ing. R.G.A. Bults. You can also contact the ethics committee that approved this research: ethicscommittee-cis@utwente.nl

Informed Consent

By participating you hereby declare that you have been informed in a manner which is clear to you about the nature and method of the research as described in the aforementioned introduction. You agree of your own free will to participate in this research. You reserve the right to withdraw this consent without the need to give any reason and you are aware that you may withdraw from the experiment at any time.

If your research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. Your personal data will not be disclosed to third parties without your express permission. If you request further information about the research, now or in the future, you may contact Joshua van der Meer, j.vandermeer@student.utwente.nl or supervisor Job Zwiers, j.zwiers@utwente.nl.

If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Electrical Engineering, Mathematics and Computer Science at the University of Twente, P.O. Box 217, 7500 AE Enschede (NL), email: ethicscommittee-cis@utwente.nl).

28/06/2021   Interactive Travel Check - User Test

1.   Do you wish to participate? *

Mark only one oval.

⬭ Yes   *Skip to question 2*

⬭ No   *Skip to section 8 (End of user test)*

Tasks

Before continuing the questionnaire, please click the link below (will open the application in another tab). You will be redirected to the application, where you have to execute the tasks and answer the corresponding question. It is recommended to switch between this form and application in between tasks.

Link to application:
https://joshuavandermeer.nl/projects/travelcheck/

Task 1
You are invited to a conference in Edinburgh. There is no possibility to visit online, but you really want to go. Find out how you can get to Edinburgh in person.

2.   How long does it take to get to Edinburgh by train? *

_____

3.   Which travel mode would you personally use after seeing the travel options? *

Mark only one oval.

⬭ Train

⬭ Plane

⬭ Carpooling

⬭ Electric car

⬭ Car

4.   What travel mode would you have chosen prior to using the travel check? *

Mark only one oval.

⬭ Train

⬭ Plane

⬭ Carpooling

⬭ Electric car

⬭ Car

Task 2
Navigate back to the start of the travel check. Suppose you are a professor that wants to record a microlecture. Find out how you can do this.

5.   How much does it cost to record a lecture? *

_____

Task 3
The travel check is meant to help achieve the sustainability goals at the UT. These goals can also be found in the travel check. Try to find them and answer the questions.

6.   How much CO_2 reduction does the UT want to achieve by 2023 compared to 2020? *

_____

7.   How much does mobility contribute to the current (2019) CO_2 footprint? *

Mark only one oval.

⬭ 15%

⬭ 27%

⬭ 31%

⬭ 48%

Task completion

Questions about the tasks and if you were able to complete them

8. In general, how difficult did you think it was to complete the tasks? *

Mark only one oval.

	1	2	3	4	5	
Very difficult	◯	◯	◯	◯	◯	Very easy

9. Which task was most difficult? *

Mark only one oval.

◯ Task 1: Conference in Edinburgh

◯ Task 2: Microlecture

◯ Task 3: Sustainability goals

10. Why did you think this task was difficult? *

_____

_____

_____

_____

_____

11. Do you have any remarks about the tasks?

_____

_____

_____

_____

_____

| User Experience | This section aims to find out how users perceive the user experience of the application. |

12.   What is your overall impression of the travel check? *

_____

_____

_____

_____

_____

13.   The travel check was easy to navigate *

Mark only one oval.

	1	2	3	4	5	
Very difficult	◯	◯	◯	◯	◯	Very easy

14.   The presented information was clear and easy to take in *

Mark only one oval.

	1	2	3	4	5	
Very difficult	◯	◯	◯	◯	◯	Very easy

15.   Was anything surprising or did not perform as expected?

_____

_____

_____

_____

_____

16.   What would keep you from using this product?

_____
_____
_____
_____
_____

17.   What do you expect to gain from using this product?

_____
_____
_____
_____
_____

18.   What was the one thing you liked the most about the design?

_____
_____
_____
_____
_____

19.   What was the one thing you disliked the most about the design?

_____
_____
_____
_____
_____

20.   Any further remarks or tips?

_____

_____

_____

_____

_____

Usability Test

This section is meant to determine the usability of the application.

21.   I think that I would like to use this system frequently. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

22.   I found the system unnecessarily complex. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

23.   I thought the system was easy to use. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

24.   I think that I would need the support of a technical person to be able to use this
      system. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

25.   I found the various functions in this system were well integrated. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

26.   I thought there was too much inconsistency in this system. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

27.   I would imagine that most people would learn to use this system very quickly. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

28/06/2021   Interactive Travel Check - User Test

28.   I found the system very cumbersome to use. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

29.   I felt very confident using the system. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

30.   I needed to learn a lot of things before I could get going with this system. *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Demographics   A few questions about you.

31.   What is your gender? *

Mark only one oval.

◯ Female

◯ Male

◯ Prefer not to say

◯ Other: _____

32. What is your nationality? *

_____

33. What is your age? *

_____

34. What device did you use for the travel check? *

Mark only one oval.

◯ PC

◯ Phone

◯ Tablet

◯ Other: _____

End of user test

Thanks for participating! Your input will be used to evaluate the travel check and hopefully improve it in the future.

This content is neither created nor endorsed by Google.

Google Forms

Appendix 2: User Test Results

How long does it take to get to Edinburgh by train?

20 responses
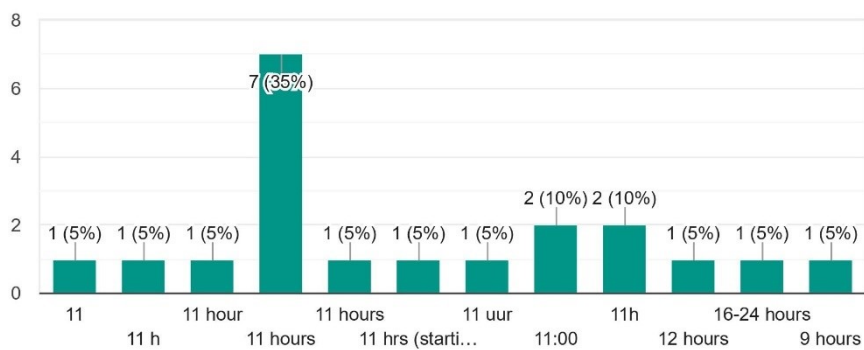
Which travel mode would you personally use after seeing the travel options?
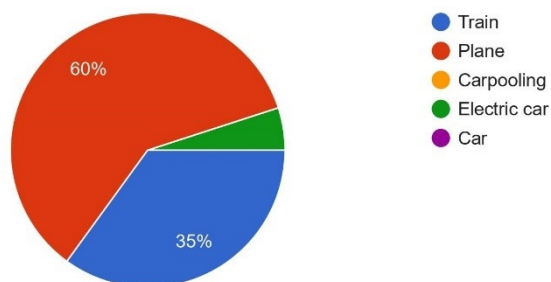
20 responses

What travel mode would you have chosen prior to using the travel check?
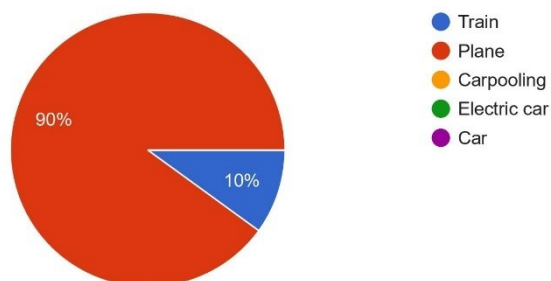
20 responses

Task 2

How much does it cost to record a lecture?

20 responses
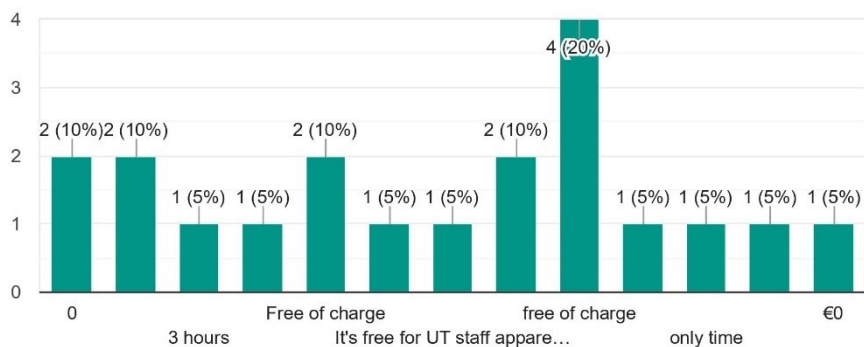
Task 3

How much CO2 reduction does the UT want to achieve by 2023 compared to 2020?

20 responses
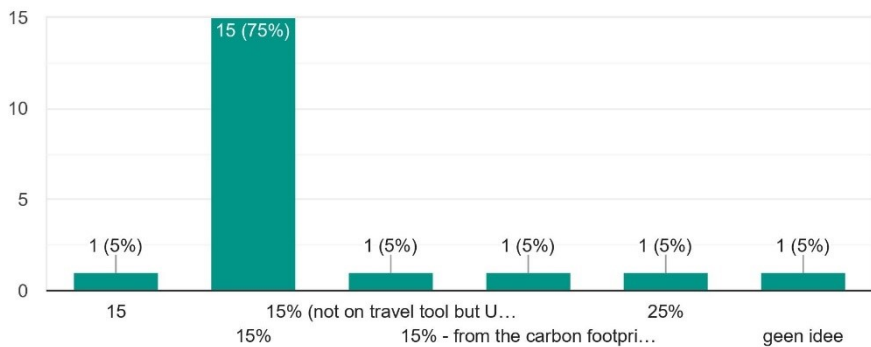
How much does mobility contribute to the current (2019) CO2 footprint?

20 responses

- ● 15%
- ● 27%
- ● 31%
- ● 48%

(Pie chart values: 50%, 45%)
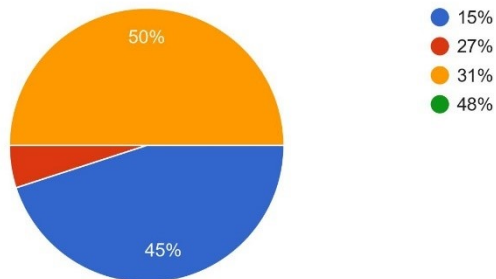
Task completion

In general, how difficult did you think it was to complete the tasks?

20 responses

(Bar chart values: 1: 0 (0%), 2: 1 (5%), 3: 3 (15%), 4: 12 (60%), 5: 4 (20%))
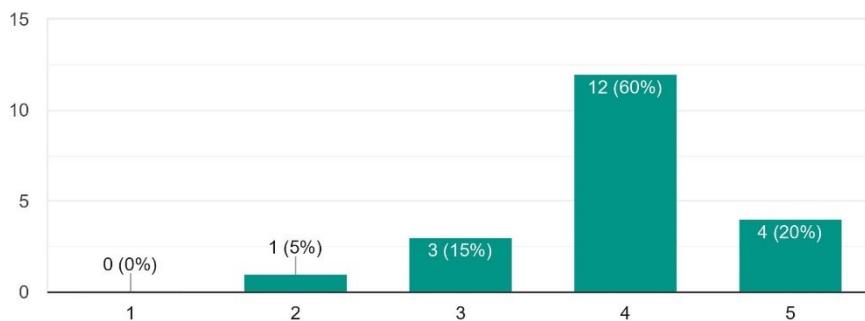
Which task was most difficult?

20 responses

- ● Task 1: Conference in Edinburgh
- ● Task 2: Microlecture
- ● Task 3: Sustainability goals

Why did you think this task was difficult?

20 responses

because I am in a hurry so I simply guessed in stead of looking it up

I don't know the UT goals on this topic

Had to guess which link would have the information

Because it was not complete, otherwise it would have been Task 3

Secondary site

I wasn't sure how long the transfer times were (or if you need to change train stations in london) and if home to train station travel time was included.

I had to read the carbon footprint to find the answers

Finding the sustainability goals in 2023

sorry, it was too much to search for in this online questionnaire... This takes too much

Why did you think this task was difficult?
because I am in a **hurry** so I simply **guessed** in stead of looking it up

I **don't know** the UT goals on this topic
Had to guess which link would have the information
Because it was not complete, otherwise it would have been Task 3
Secondary site
I wasn't sure how long the **transfer time**s were (or if you need to change train stations in london) and **if home to train station travel time** was included.
I had t**o read the carbon footprint to find the answers**
F**inding the sustainability goals in 2023**
sorry, it was **too much to search** for in this online questionnaire... T**his takes too much time**.
took me a while to find the answers ;)
wasnt clear which link had this information, then it was very **detailed**
It wasn't difficult, it was the le**ss easy because it was down at the bottom**
could not find it.
didn't find it
read through some info
external link
eerst v**erkeerde link aangeklikt**
Estimating multi-leg international train journeys without research of the routes, pricings and schedules is tricky but not impossible.
compared to the first two tasks, it **involved more clicking and reading through different websites;** in addition, summing up different modes of travel to come to the final result
c**ould'nt find it so quickly**

g

76

02/07/2021   Interactive Travel Check - User Test

Do you have any remarks about the tasks?

12 responses

no

Easy to do, helpfull to think about other options. (maybe take the time for flying or train with pre-train and watingtime included)

Nice approach to test the usability of a site!

-

No

good luck with developing the travel check, it looks good and I think it can be very useful

the CO_2-emission from Edinburgh is 53. 53 what? is this in kg co2? it doesn't yet say.

and I think it is of no interest if you have to travel you want to travel as fast as possible,

User Experience

https://docs.google.com/forms/d/1GNdR6x2WXJkX40GIplGgR4LmV-Ru2cebmicnaHeqO00/viewanalytics   6/20

Do you have any remarks about the tasks?

Easy to do, helpfull to think about other options. (maybe take the time for flying or train with pre-train and watingtime included)
Nice approach to test the usability of a site!
-
No
no
no
good luck with developing the travel check, it looks good and I think it can be very useful
the CO2-emission from Edinburgh is 53. 53 what? is this in kg co2? it doesn't yet say.
and I think it is of no interest if you have to travel you want to travel as fast as possible,
no
Rather practical to someone considering a conference
no

78

What is your overall impression of the travel check?

20 responses

nice but the first question do you really want to go can be a nuisance to some people (we have already considered that before planning a trip)

easy to use, helpful

Useful tool - nicely guided through the options

Looks good, I assume more cities will be added.

Nice

Looks good, I miss some details whether travel time is total travel time incl transfer time or not.

That you are aware of the CO2 emissions.

It is nicely done. Clear and simple

The travel check was easy to navigate

20 responses
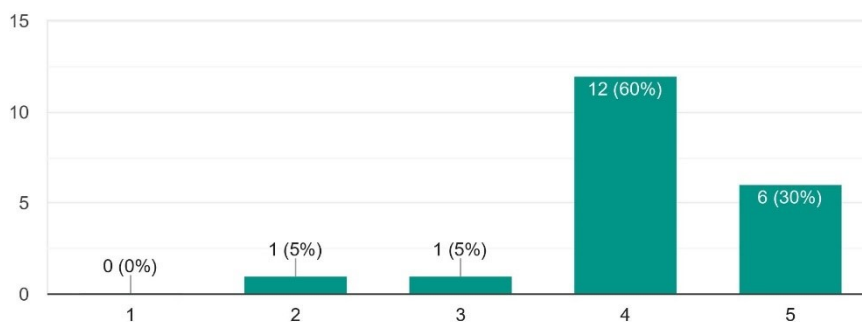
What is your overall impression of the travel check?

nice but the first question do you really want to go can be a nuisance to some people (we have already considered that before planning a trip)

easy to use, helpful
Useful tool - nicely guided through the options
Looks good, I assume more cities will be added.
Nice
Looks good, I miss some details whether travel time is total travel time incl transfer time or not.
That you are aware of the CO_2 emissions.
It is nicely done. Clear and simple
the suggestions feels a bit like parental control is required...
easy to use and informative
could be helpful if you understand the different possibilities
Looks usefull to have an overview of alternatives
work quite naturally
hmm
easy
good to use
nice
Good
it appears to be able to help with initial decisions on the mode of transport vs time involved
don't think it is useful

The presented information was clear and easy to take in

20 responses

Rating	Count
1	0 (0%)
2	2 (10%)
3	2 (10%)
4	10 (50%)
5	6 (30%)
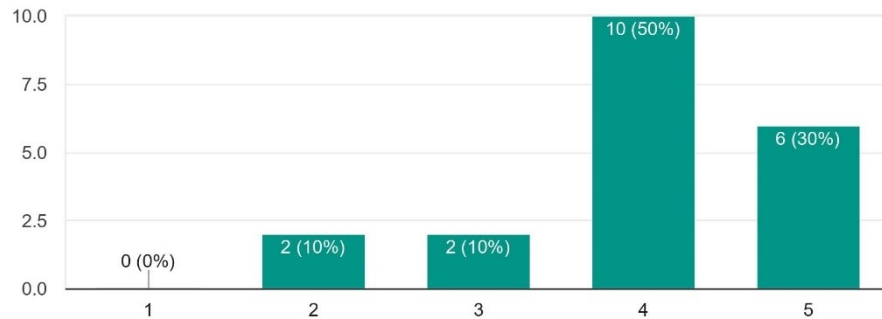
Was anything surprising or did not perform as expected?

18 responses

no

No

I typed in 5 destinations that were not recognized, before chosing one that was.

that microlectures are free of charge :-)

behind car was no additional info

-

the creating videos part is good to share!

as before, it is not clear what the number of CO_2 refers to. kg CO_2 equivalent?

Everything worked well

Was anything surprising or did not perform as expected?
I typed in 5 destinations that were not recognized, before chosing one that was.

that microlectures are free of charge :-)
No
no
No
behind car was no additional info
-
No
the creating videos part is good to share!
No
as before, it is not clear what the number of co2 refers to. kg co2 equivalent?
Everything worked well
no
no
no
I expected it
Seems simpler than I thought but maybe this is a good thing.
no

What would keep you from using this product?

17 responses

nothing

do I need to look for it somewhere or type in a lot of passwords?

curiousity, easy to find out what takes more time (although time maybe not the only value, costs might be another one)

After a view checks I think I can predict the distance/co2 value

Maybe

laziness

The workload I'm dealing with.

Its biased. The trip to Edinburgh will take about 4 hours 30 minutes but you cannot get to Edinburgh in 11 hours. 13 hours by Thalis en 18 hours, 30 minutes by normal trains.

What would keep you from using this product?
do I need to look for it somewhere or type in a lot of passwords?

curiousity, easy to find out what takes more time (although time maybe not the only value, costs might be another one)
After a view checks I think I can predict the distance/co2 value
Maybe
laziness
The workload I'm dealing with.
Its biased. The trip to Edinburgh will take about 4 hours 30 minutes but you cannot get to Edinburgh in 11 hours. 13 hours by Thalis en 18 hours, 30 minutes by normal trains.
?
depends how it is implemented, if it is yet an extra step /extra app to use before travelling, people may not use it that quickly or forget to use it, if it is part of the booking system alltogether it would work better.
not finding the link within 1 click
There is no link afterwards, if you press more, a link to for example the travel agency would make it complete.
the link to book the faciliets in the spiegel, link to book your trainticket
time
nothing
-
nothing
personal preferences of the traveller (e.g. preferring air or car travel due to time restrictions)

What do you expect to gain from using this product?

18 responses

quick trip advice with carbon footprint - carbon footprint is difficult to get an objective value for

To be more aware about alternatives

I can make more informed choices

An indication to go by train or plane. For instance your trip to Edinburgh can't be booked by NS International, it does not give me options......

Little

alternatives to what I usually do

Awareness of CO2 emissions.

The product is okay, the information should be accurate.

What do you expect to gain from using this product?

quick trip advice with carbon footprint - carbon footprint is difficult to get an objective value for

To be more aware about alternatives
I can make more informed choices
An indication to go by train or plane. For instance your trip to Edinburgh can't be booked by NS International, it does not give me options......
Little
alternatives to what I usually do
Awareness of CO_2 emissions.
The product is okay, the information should be accurate.
booking flights/trains?
more awareness about the "costs" of the planet for travelling, but also informs about other ways to travel and how long it takes to travel
more information about what the best option could be
An overview of the different alternatives
it should reduce the work not create an extra step
info
awareness
Clarity and time-saving
more insight on alternative modes of transport
nothing

What was the one thing you liked the most about the design?

17 responses

big green buttons with all travel options in one overview and more detail if you click on them

easy to use

It's very clean, no clutter

Simplicity

Easy to use

clear icons and language

In the upper space when you click with your mouse on the two icons; it fills up and down.

it is simple

What was the one thing you liked the most about the design?
big green buttons with all travel options in one overview and more detail if you click on them

easy to use
It's very clean, no clutter
Simplicity
Easy to use
clear icons and language
In the upper space when you click with your mouse on the two icons; it fills up and down.
it is simple
-
informs about other ways to travel and how long it takes to travel
clear images
Simple, clear, no knowledge needed
natural feel.
the colours
design is good, clear.
Clean, smart, easy on the eye, can do quickly
intuitive use

What was the one thing you disliked the most about the design?

14 responses

-

the first question holds me up

Only limited number of Cities

Nothing

?

Nothing, its okay

None

i cant select using an electric car + carpooling

nothing

What was the one thing you disliked the most about the design?

the first question holds me up

Only limited number of Cities
Nothing
?
-
Nothing, its okay
-
None
i cant select using an electric car + carpooling
nothing
not really
that I did not find the option to record lectures! WHERE is the button?! :-(
-
n.a.

Any further remarks or tips?

12 responses

No

-

include all hrs and maybe costs in the comparison (we still think in financial business cases)

Add more destinations

The user test takes more than 5-10 minutes.

Good luck

can we have electric UT cars for car pooling to conferences? that would help

if it is meant that all emplyees will book their own journey by plane, I think it will need an extra step - approval before the definite booking is set through. Preferably by the secretary who is now also in charge of the flight arranging.

Usability Test

I think that I would like to use this system frequently.

20 responses

Any further remarks or tips?

Add more destinations
No
-
The user test takes more than 5-10 minutes.
No
-
Good luck
can we have electric UT cars for car pooling to conferences? that would help
if it is meant that all emplyees will book their own journey by plane, I think it will need an extra step - approval before the definite booking is set through. Preferably by the secretary who is now also in charge of the flight arranging.
no
not yet

Interactive Travel Check - User Test

I found the system unnecessarily complex.

20 responses
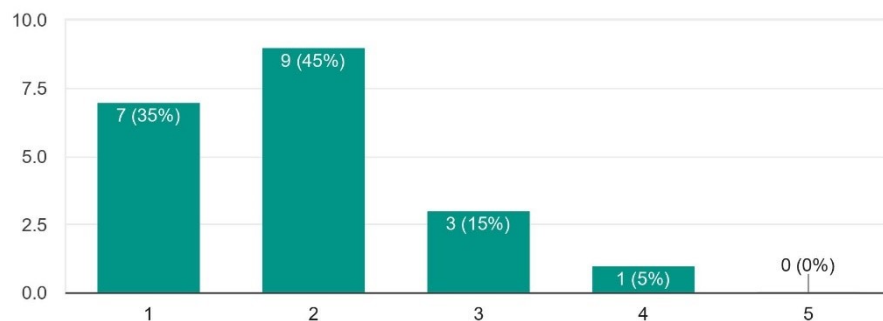
I thought the system was easy to use.

20 responses
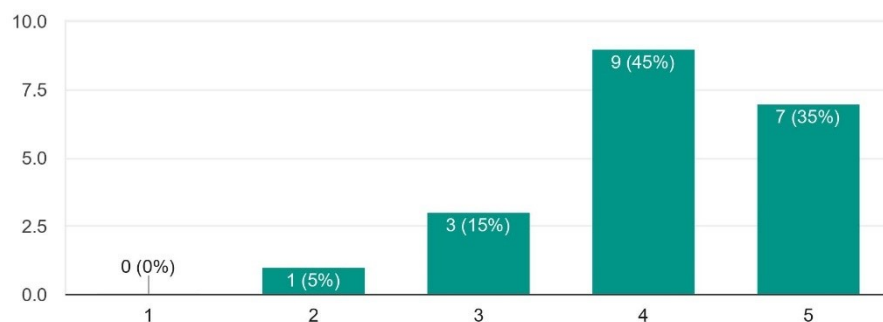
I think that I would need the support of a technical person to be able to use this system.
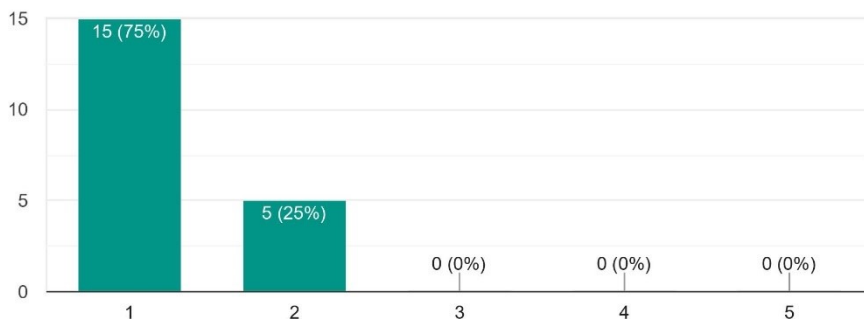
20 responses

I found the various functions in this system were well integrated.

20 responses
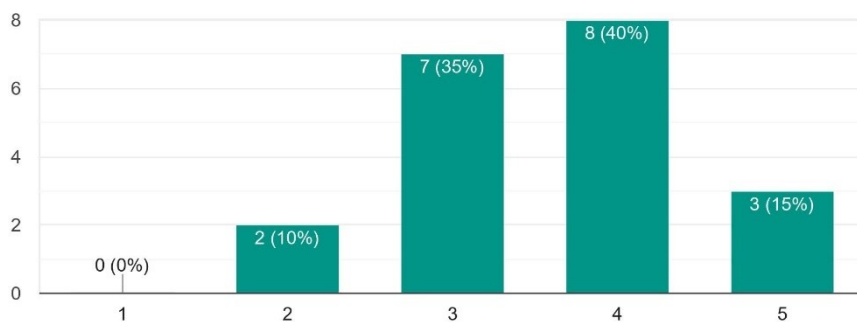
I thought there was too much inconsistency in this system.
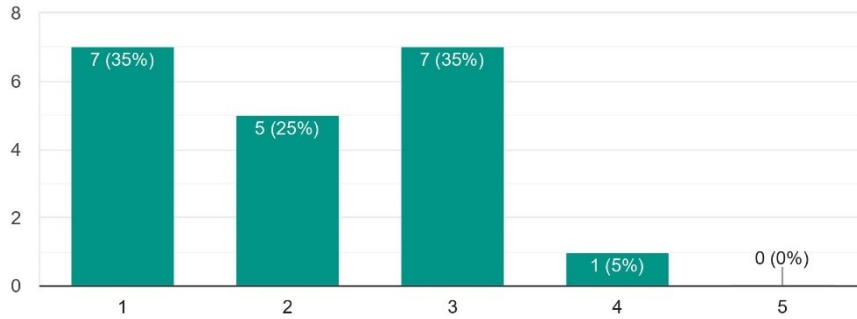
20 responses

I would imagine that most people would learn to use this system very quickly.

20 responses
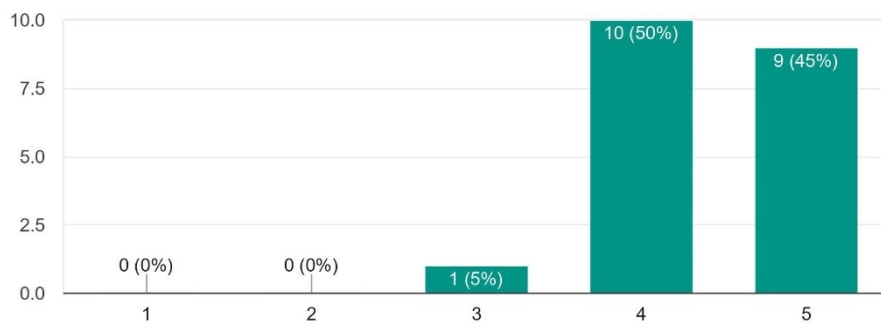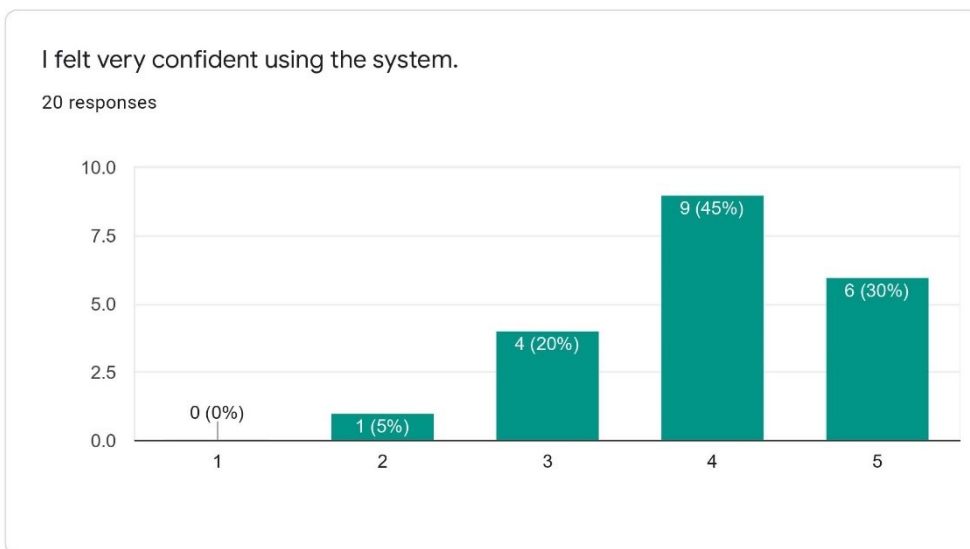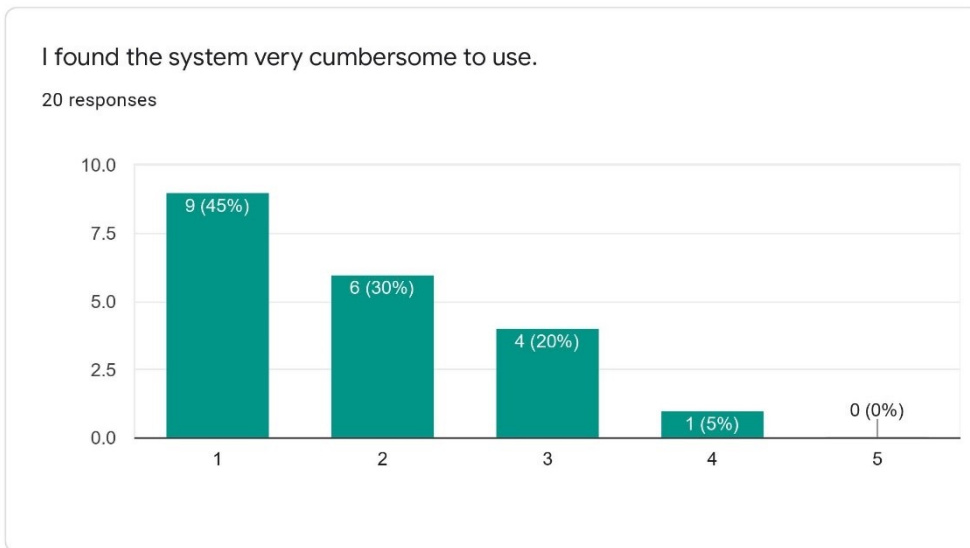
I found the system very cumbersome to use.

20 responses

I felt very confident using the system.

20 responses

I needed to learn a lot of things before I could get going with this system.

20 responses
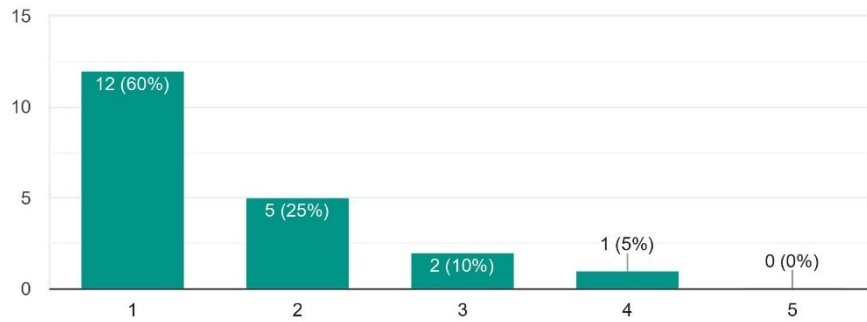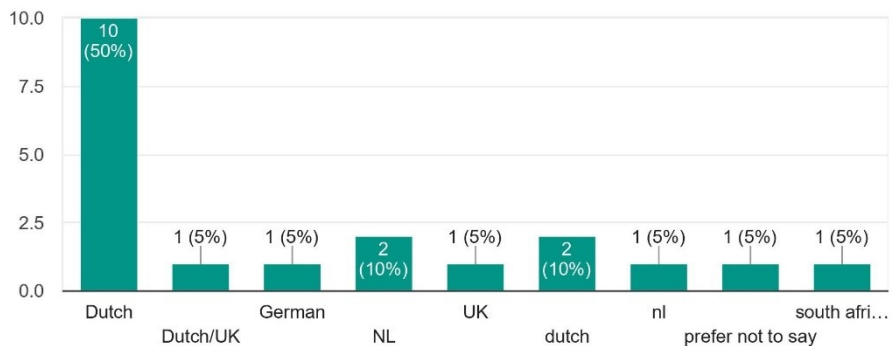

Demographics

What is your gender?

20 responses

- ● Female
- ● Male
- ● Prefer not to say
- ● nonbinary

25%

65%
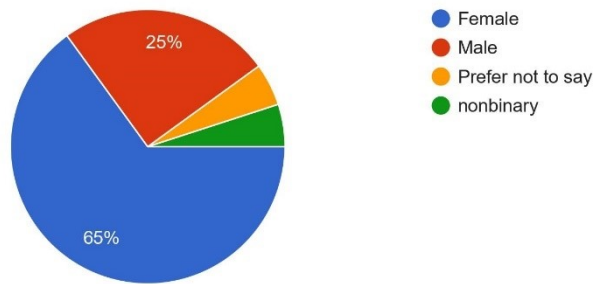
What is your nationality?

20 responses

What is your age?

20 responses
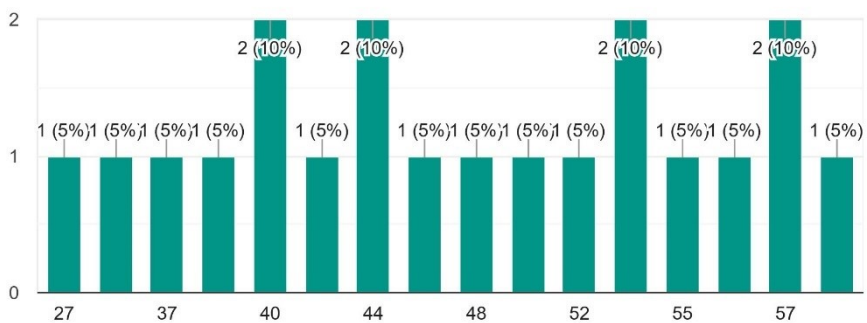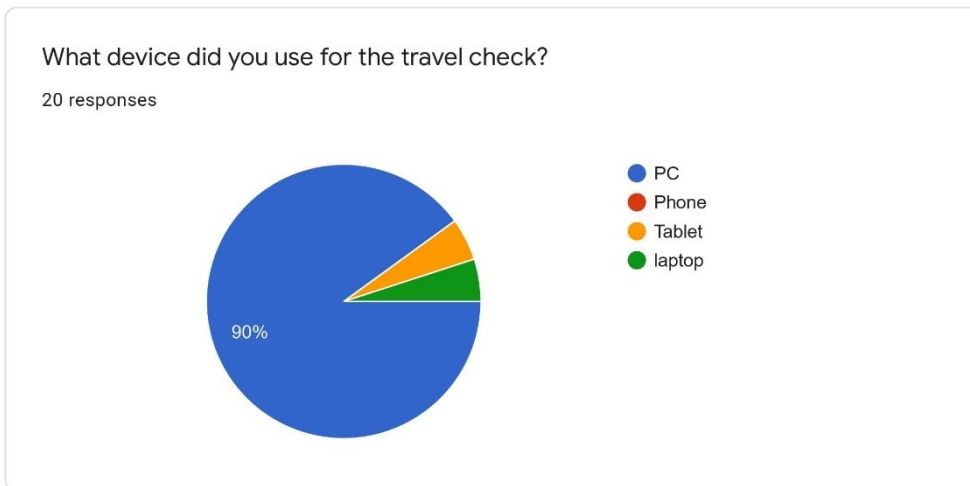
What device did you use for the travel check?

20 responses

- PC
- Phone
- Tablet
- laptop

90%

End of user test

Google Forms

Appendix 3: Decision Tree
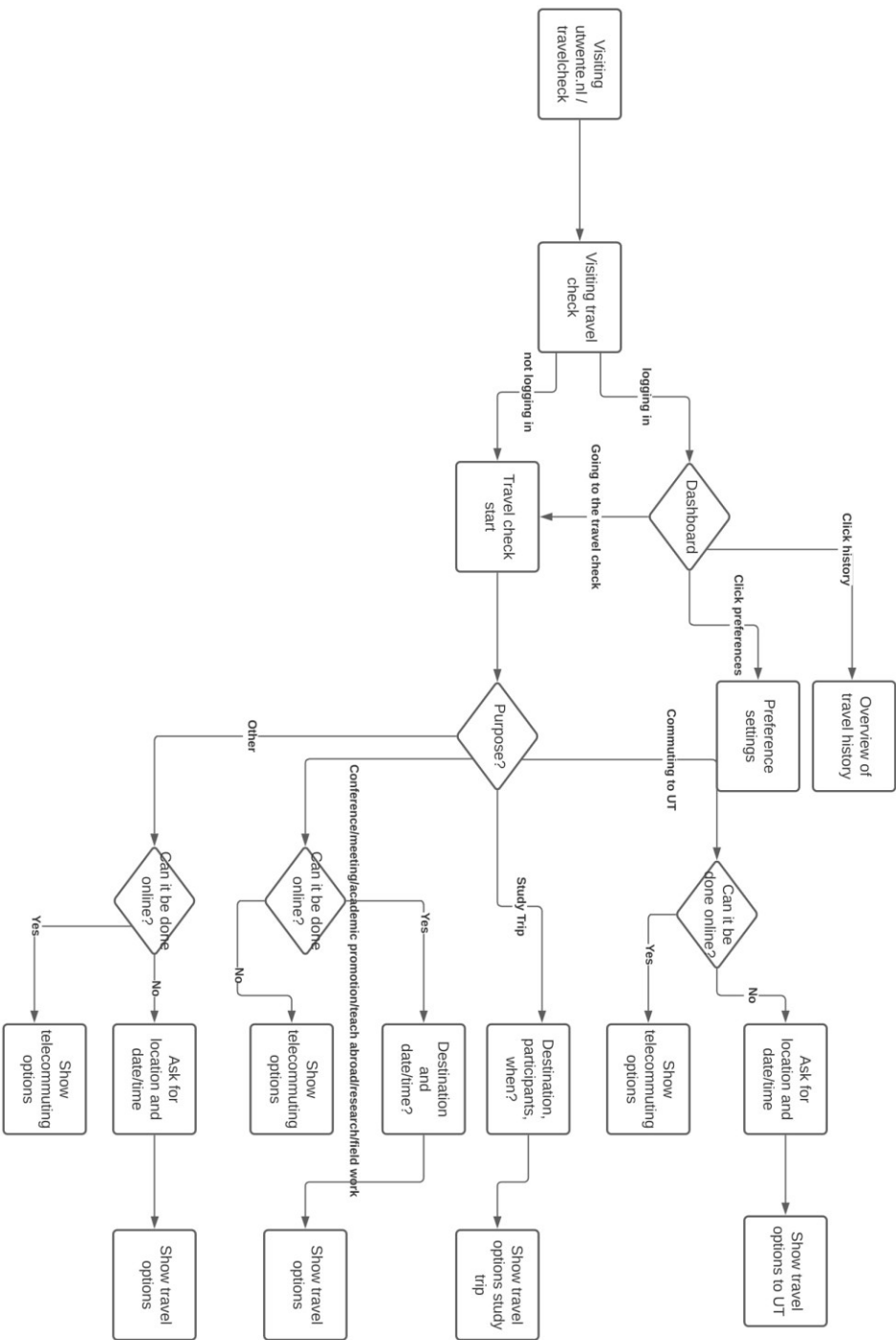
Travel distances:
1) < 2 km
2) < 7.5 km
3) < 20 km
4) < 800 km / easy to reach by train
5) > 800 km / difficult by train

Travel Modes:
a. Walking
b. Cycling
c. E-bike
d. Public transport
e. Train
f. Plane
g. Electric car
h. Carpooling
i. Private car

Travel categories + recommendations
1) a, b, c, d
2) b, c, d, h
3) c, d, e, h, g
4) e, h, g, f, i
5) f, h, g, i

Appendix 4: Wireframes

≡

Commuting

Conference

What is the Purpose of
your Travel?

Meeting

Other...

≡

What is the Purpose of
your Travel?

Commuting

Conference

Meeting

Other...

≡ ≡

What is the Purpose of your Travel?

Commuting

Other...

Commuting

Conference

Meeting

☰

What is the Purpose of your Travel?

Commuting	Conference
Meeting	Teaching
Research	Other...

☰

What is the Purpose of your Travel?

Commuting

Other...

≡

Commuting

Conference

What is the Purpose
of your Travel?

Meeting

Other...

≡

What is the Purpose
of your Travel?

Commuting

Conference

Other...

Appendix 5: Screenshots of Final Prototype

University of Twente

‹ Back | Travel Purpose

WHAT IS THE PURPOSE OF YOUR TRIP?

COMMUTING   OTHER

RELEVANT LINKS

Sustainability at University of Twente
Carbon Footprint
Mobility

© 2021 - University of Twente

University of Twente

‹ Back | Travel Purpose > Commuting: Remotely

COULD YOU DO YOUR WORK REMOTELY?

PERHAPS...   NO, GO IN PERSON

RELEVANT LINKS

Sustainability at University of Twente
Carbon Footprint
Mobility

© 2021 - University of Twente

University of Twente

< Back | Travel Purpose > Commuting: Remotely > Remote Commuting Options

HERE IS HOW YOU CAN TELECOMMUTE.

Creating videos

Videos, presentations and microlectures can be recorded in the DIY-studio or Studio 200.

Location: Spiegel 200 and 206

Cost: Free of charge

BOOK STUDIO ⤴

VIEW AVAILABILITY ⤴

Video Storage

Faculties and service departments can use the LISA accounts to upload videos to the Vimeo server. LISA can upload the videos, but the account can also be shared to allow faculty staff to upload the video(s) themselves.

Meeting online?

Microsoft Teams
You can use Teams to invite your colleagues to chat, meet, call and work together. This can all be done in one place, wherever you are.

TEAMS INFO ⤴

Zoom
Zoom is a video communications platform. It can be used for non-confidential one-on-one or group meetings.

ZOOM INFO ⤴

Not the info you were looking for?
More information is available on the website of the University of Twente.

RELEVANT LINKS

Sustainability at University of Twente
Carbon Footprint
Mobility

University of Twente

< Back | Travel Purpose? > Commuting: Remotely? > Commuting: Info

WHERE ARE YOU TRAVELLING FROM?

Your location (optional):

Retrieve

→

CONTINUE

RELEVANT LINKS

Sustainability at University of Twente
Carbon Footprint
Mobility

University of Twente

‹ Back | Travel Purpose? > Commuting: Remotely? > Commuting: Info > Commuting to UT

THIS IS HOW YOU CAN GET TO THE UNIVERSITY OF TWENTE.

GO WALKING

MORE +

GO CYCLING

MORE +

TAKE THE E-BIKE

MORE +

USE THE PUBLIC TRANSPORT

MORE +

GO CARPOOLING

MORE +

USE AN ELECTRIC CAR

MORE +

GO BY CAR

University of Twente
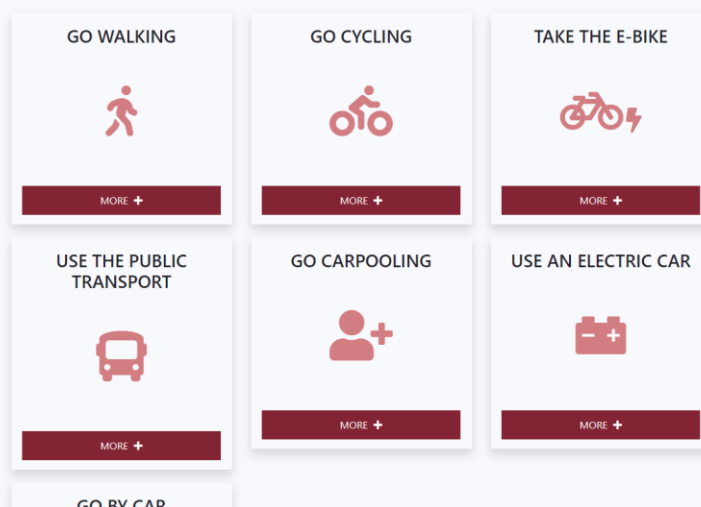
‹ Back | Travel Purpose > Other: Remotely

DO YOU REALLY HAVE TO GO IN PERSON?

PERHAPS NOT...

YES, I HAVE TO GO IN PERSON

RELEVANT LINKS

Sustainability at University of Twente
Carbon Footprint
Mobility

© 2021 - University of Twente

University of Twente

‹ Back | Travel Purpose > Other: Remotely > Destination

WHERE DO YOU WANT TO GO?

Destination:

Search...

Your location (optional):

Retrieve

→

CONTINUE

RELEVANT LINKS

Sustainability at University of Twente
Carbon Footprint
Mobility

© 2021 - University of Twente

University of Twente

‹ Back | Travel Purpose > Other: Remotely > Destination

WHERE DO YOU WANT TO GO?

Destination:

London ✓

Your location (optional):

Retrieved

→

CONTINUE

RELEVANT LINKS

Sustainability at University of Twente
Carbon Footprint
Mobility

© 2021 - University of Twente

University of Twente

‹ Back | Travel Purpose > Other: Remotely > Destination > Visiting in person

THIS IS HOW YOU CAN GET TO LONDON.

TAKE THE TRAIN

🚆

🕐 04:30   🌫 25   ⇄ 2

MORE +

TAKE THE PLANE

✈️

🕐 04:00   🌫 217   ⇄ 2

MORE +

GO CARPOOLING

👤+

MORE +

USE AN ELECTRIC CAR

🔋

MORE +

GO BY CAR

🚗

MORE +

RELEVANT LINKS

Sustainability at University of Twente

Train   ×

Travel Details
The following information presents an estimation of travel duration, CO_2-emission and the amount of transfers.

Duration	CO_2-emission	Transfers
04:30	25	2

Relevant Links and Articles

Work travel by train is facilitated and encouraged by the provision of an NS Business card.

For online bookings with a personal card, go to 'Mijn NS Zakelijk'.

Before traveling with the business card, read the terms of use.`

Plan your journey with NS.`

Close

Appendix 6: Code Database Pages

Since the travel uses dynamic content, the actual code for most of the pages is stored in the database. The following code belongs to these pages.

purpose
```
"<div class=""row"">
<div class=""col-sm-6"">
<a href='#commuting_remotely' onclick=""changeState('commuting_remotely')"">
<div class=""decision shadow"">
<i class=""fas fa-building decision-icon""></i>
<div class='decision-bottom'>
Commuting
</div>
</div>
</a>
</div>
<!--
<div class=""col-sm-4"">
<a href='#study_trip_destination' onclick=""changeState('study_trip_destination')"">
<div class=""decision shadow"">
<i class=""fas fa-suitcase-rolling decision-icon""></i>
<div class='decision-bottom'>
Study trip
</div>
</div>
</a>
</div>
-->
<div class=""col-sm-6"">
<a href='#other_remotely' onclick=""changeState('other_remotely')"">
<div class=""decision shadow"">
<i class=""fas fa-ellipsis-h decision-icon""></i>
<div class='decision-bottom'>
OTHer
</div>
</div>
</a>
</div>"
```

commuting_remotely
```
"<div class=""row"">
<div class=""col-sm-6"">
<a href='#commuting_remotely_possible' onclick=""changeState('commuting_remotely_possible')"">
<div class=""decision shadow"">
<i class=""fas fa-laptop-house decision-icon""></i>
<div class='decision-bottom'>
Perhaps...
</div>
</div>
</a>
</div>
<div class=""col-sm-6"">
<a href='#commuting_request_info' onclick='changeState(""commuting_request_info"")'>
```

```
<div class=""decision shadow"">
<i class=""fas fa-user-friends decision-icon""></i>
<div class='decision-bottom'>
No, go in person
</div>
</div>
</a>
</div>
</div>"
```

commuting_remotely_possible
```
"<div class=""row"">
<div class='col-sm-4'>
<div class='shadow padding'>
<h3>Creating videos</h3><br>
<p>Videos, presentations and microlectures can be recorded in the DIY-studio or Studio 200. </p>
<table class='table'>
<tr><td>Location:</td><td>Spiegel 200 and 206</td></tr>
<tr><td>Cost:</td><td>Free of charge</td></tr>
</table>
<a href='https://www.utwente.nl/nl/intranet/lisaut/webform/videoteam/' target='blank'>
<button style='width: 100%; margin: 0px; margin-bottom: 5px;' class='btn decision-bottom modal-button'>Book studio <i class=""fas fa-external-link-square-alt""></i></button>
</a>
<a href='https://diystudio.planner.utwente.nl/#/en' target='blank'>
<button style='width: 100%; margin: 0px;' class='btn decision-bottom modal-button'>View availability <i class=""fas fa-external-link-square-alt""></i></button>
</a>
</div>
</div>
<div class='col-sm-4'>
<div class='shadow padding'>
<h3>Video Storage</h3><br>
<p>Faculties and service departments can use the LISA accounts to upload videos to the Vimeo server. LISA can upload the videos, but the account can also be shared to allow faculty staff to upload the video(s) themselves. </p>
</div>
</div>
<div class='col-sm-4'>
<div class='shadow padding'>
<h3>Meeting online?</h3><br>
<p>
<strong>Microsoft Teams</strong><br>
You can use Teams to invite your colleagues to chat, meet, call and work together. This can all be done in one place, wherever you are.
</p>
<a href='https://www.utwente.nl/en/service-portal/workplace-support/phone-services-incl.-teams/microsoft-teams/about-microsoft-teams-general-information-faq' target='blank'>
<button style='width: 100%; margin: 0px;' class='btn decision-bottom modal-button'>teams info <i class=""fas fa-external-link-square-alt""></i></button>
</a>
<br><br />
<p>
<strong>Zoom</strong><br>
```

Zoom is a video communications platform. It can be used for non-confidential one-on-one or group meetings.
</p>

<button style='width: 100%; margin: 0px;' class='btn decision-bottom modal-button'>ZOOm info <i class=""fas fa-external-link-square-alt""></i></button>

</div>
</div>
</div>

<div class='row'>
<div class='col-sm-12 text-center'>
<div class='padding text-muted'>
<h3>Not the info you were looking for?</h3>
<p>More information is available on the website of the University of Twente.</p>
</div>
</div>
</div>
"

commuting_in_person
"<div class=""row"" id='travelSuggestions'>
</div>"

other_remotely
"<div class=""row"">
<div class=""col-sm-6"">

<div class=""decision shadow"">
<i class=""fas fa-laptop-house decision-icon""></i>
<div class='decision-bottom'>
Perhaps not...
</div>
</div>

</div>
<div class=""col-sm-6"">

<div class=""decision shadow"">
<i class=""fas fa-user-friends decision-icon""></i>
<div class='decision-bottom'>
Yes, I have to go in person
</div>
</div>

</div>
</div>"

other_remotely_possible
"<div class=""row"">
<div class='col-sm-4'>

```
<div class='shadow padding'>
<h3>Meeting online?</h3><br>
<p>
<strong>Microsoft Teams</strong><br>
You can use Teams to invite your colleagues to chat, meet, call and work together. This can all be done
in one place, wherever you are.
</p>
<a          href='https://www.utwente.nl/en/service-portal/workplace-support/phone-services-incl.-
teams/microsoft-teams/about-microsoft-teams-general-information-faq' target='blank'>
<button style='width: 100%; margin: 0px;' class='btn decision-bottom modal-button'>teams info <i
class=""fas fa-external-link-square-alt""></i></button>
</a>
<br><br />
<p>
<strong>Zoom</strong><br>
Zoom is a video communications platform. It can be used for non-confidential one-on-one or group
meetings.
</p>
<a          href='https://www.utwente.nl/en/service-portal/workplace-support/phone-services-incl.-
teams/zoom-incl-faq#zoom' target='blank'>
<button style='width: 100%; margin: 0px;' class='btn decision-bottom modal-button'>ZOOm info <i
class=""fas fa-external-link-square-alt""></i></button>
</a>
</div>
</div>
<div class='col-sm-4'>
<div class='shadow padding'>
<h3>Creating videos</h3><br>
<p>Videos, presentations and microlectures can be recorded in the DIY-studio or Studio 200. </p>
<table class='table'>
<tr><td>Location:</td><td>Spiegel 200 and 206</td></tr>
<tr><td>Cost:</td><td>Free of charge</td></tr>
</table>
<a href='https://www.utwente.nl/nl/intranet/lisaut/webform/videoteam/' target='blank'>
<button style='width: 100%; margin: 0px; margin-bottom: 5px;' class='btn decision-bottom modal-
button'>Book studio <i class=""fas fa-external-link-square-alt""></i></button>
</a>
<a href='https://diystudio.planner.utwente.nl/#/en' target='blank'>
<button style='width: 100%; margin: 0px;' class='btn decision-bottom modal-button'>View
availability <i class=""fas fa-external-link-square-alt""></i></button>
</a>
</div>
</div>
<div class='col-sm-4'>
<div class='shadow padding'>
<h3>Video Storage</h3><br>
<p>Faculties and service departments can use the LISA accounts to upload videos to the Vimeo server.
LISA can upload the videos, but the account can also be shared to allow faculty staff to upload the
video(s) themselves. </p>
</div>
</div>

</div>
<br>
<div class='row'>
```

```
<div class='col-sm-12 text-center'>
<div class='padding text-muted'>
<h3>Not the info you were looking for?</h3>
<p>More information is available on the <a href='https://utwente.nl/video' target='blank'>website of the
University of Twente</a>.</p>
</div>
</div>
</div>
"
```

other_in_person
```
"<div class=""row"" id='travelSuggestions'>
</div>
"
```

other_city_of_destination
```
"<div class=""row"">
<div class=""col-sm-8"">
<div class=""form-box shadow"">
<div class=""form-group"">
<label for=""destination"">Destination:</label>
<input type=""text"" oninput='recommendDestination()' class=""form-control""
placeholder=""Search..."" id=""destination"">
<ul class=""list-group"" id='destinationContainer'></ul>
<br>
<label for=""location"">Your location (optional):</label><br >
<button id='locationButton' onclick='getLocation()' class='btn btn-light'>Retrieve</button>
</div>
</div>
</div>
<div class=""col-sm-4"">
<div class=""decision shadow disabled-look"" id='nextButtonContainer'>
<i class=""fas fa-arrow-right decision-icon""></i>
<a id='nextLink' href='#other_in_person' onchange=""changeState('other_in_person')"">
<button id='nextButton' disabled class='decision-bottom btn'>
Continue
</button>
</a>
</div>
</div>
</a>
</div>
</div>"
```

commuting_request_info
```
"<div class=""row"">
<div class=""col-sm-8"">
<div class=""form-box shadow"">
<div class=""form-group"">
<label for=""location"">Your location (optional):</label><br >
<button id='locationButton' onclick='getLocation()' class='btn btn-light'>Retrieve</button>
</div>
</div>
</div>
<div class=""col-sm-4"">
```

```
<div class=""decision shadow"" id='nextButtonContainer' onclick=""destinationSelected('71',
'University of Twente'); changeState('commuting_in_person'); setHash('#commuting_in_person'); "">
<i class=""fas fa-arrow-right decision-icon""></i>
<a id='nextLink' href='#commuting_in_person' onclick=""changeState('commuting_in_person');
destinationSelected('71', 'University of Twente');"">
<button id='nextButton' class='decision-bottom btn'>
Continue
</button>
</a>
</div>
</div>
</div>"
```

Appendix 7: Code

index.php

```php
<?php
session_start();

include("functions.php");
include("queries.php");
$conn = connectToDB();

$pages = getInformationZero($conn, "SELECT * FROM pages");
$destinations = getInformationZero($conn, "SELECT * FROM destinations");

if(!isset($_SESSION['destination'])){
      $_SESSION['destination'] = 0;
}

?>

<!DOCTYPE html>
<html lang="en">
<head>
  <title>UTwente Travel Check</title>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <link                                                  rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.min.css
">
  <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.5.1/jquery.min.js"></sc
ript>
  <script
src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.16.0/umd/popper.min
.js"></script>
  <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4.5.2/js/bootstrap.min.js"><
/script>
  <script src="js/functions.js"></script>
  <link                                                  rel="stylesheet"
href="https://use.fontawesome.com/releases/v5.15.3/css/all.css"
integrity="sha384-
SZXxX4whJ79/gErwcOYf+zWLeJdY/qpuqC4cAa9rOGUstPomtqpuNWT9wdPEn2fk"
crossorigin="anonymous">

  <style>


  .fadein{
      animation: fadein 1s;
   -moz-animation: fadein 1s; /* Firefox */
   -webkit-animation: fadein 1s; /* Safari and Chrome */
   -o-animation: fadein 1s; /* Opera */
  }

  .fadeout{
      animation: fadeout 1s;
   -moz-animation: fadeout 1s; /* Firefox */
   -webkit-animation: fadeout 1s; /* Safari and Chrome */
   -o-animation: fadeout 1s; /* Opera */
  }
```

```css
@keyframes fadein {
  from {
      opacity:0;
  }
  to {
      opacity:1;
  }
    }
    @-moz-keyframes fadein { /* Firefox */
         from {
               opacity:0;
         }
         to {
               opacity:1;
         }
    }
    @-webkit-keyframes fadein { /* Safari and Chrome */
         from {
               opacity:0;
         }
         to {
               opacity:1;
         }
    }
    @-o-keyframes fadein { /* Opera */
         from {
               opacity:1;
         }
         to {
               opacity: 0;
         }
    }

    @keyframes fadeout {
          from {
               opacity:1;
         }
         to {
               opacity: 0;
         }
    }
    @-moz-keyframes fadeout { /* Firefox */
           from {
               opacity:1;
         }
         to {
               opacity: 0;
         }
    }
    @-webkit-keyframes fadeout { /* Safari and Chrome */
         from {
               opacity:1;
         }
         to {
               opacity: 0;
         }
    }
    @-o-keyframes fadeout { /* Opera */
           from {
               opacity:1;
```

```css
        }
        to {
              opacity: 0;
        }
}


body {
      background-color: #F8F9FC;
}


.bg-dark {
      background-color: #1f2229 !important;
}


.list-group-item:hover{
      background-color: #f8f9fa;
      cursor: pointer;
}


.breadcrumb-item a {
      color: #343a40;
}


.breadcrumb {
      background-color: transparent;
      padding: 0px;
      margin-top: 25px;
      margin-bottom: 3vw;
}



.decision{
      text-align: center;
      background-image: linear-gradient(to top, pink 50%, white 50%);
      background-size: 100% 200%;
    background-position: top;
      transition: background-position 0.25s ease-in-out;
      margin-bottom: 20px;
}

.col-sm-4 a, .col-sm-6 a {
      text-decoration: none;
}

.decision:hover{
      background-position: bottom;
      cursor: pointer;
      color: white;
      transition: 0.25s;
}

.decision-bottom{
      text-transform: uppercase;
      padding-top: 10px;
      padding-bottom: 10px;
      width: 100%;
      background-color: green;
      color: white;
}

.decision-icon{
```

```css
        font-size: 80px;
        margin: 50px 0 40px 0;
}


.travel-mode{
        text-align: center;
        margin-bottom: 20px;
}

.travel-mode h3{
        padding: 20px 0 5px 0;
        color: #1f2229;
        text-transform: uppercase;
}


.modal-button {
        width: 90% ;
        margin: 15px ;
        color: white;
        border-radius: 0px;
}

.modal-button:hover {
        color: white;
        opacity: 0.8;
        transition: 0.25s;
}


#question {
        text-transform: uppercase;
}

body {
        color: #1f2328;
}

.back {
        font-size: 18px;
        margin-top: 20px;
        margin-bottom: 20px;
        color: #1f2328;
}

.breadcrumb-item+.breadcrumb-item::before {
        content: ">";
}

.form-box {
        padding: 20px;
        background-color: white;
        margin-bottom: 20px;
}

.disabled-look {
        pointer-events: unset;
        opacity: 0.5;
        text-decoration: none;
        display: block;
```

```css
}

.disabled-look:hover {
    cursor: not-allowed;
    background-color: transparent;
}

#nextButton:hover {
    color: white;
}

.padding {
    padding: 15px;
    margin-bottom: 20px;
}

.padding a {
    color: inherit;
    text-decoration: underline;
}

.copyright, .footer {
    background-color: #1f2229;
    color: white;
    padding-top: 20px;
    padding-bottom: 20px;
}

.copyright {
    background-color: #1f2328;
    margin-bottom: -20px;
    margin-top: 50px;
}

.navbar-dark .navbar-toggler {
    color: white;
    border: none;
}

.card {
    margin-top: 5px;
}

.card:hover {
    opacity: 0.6;
}

#linksAndArticleContainer a {
    text-decoration: none;
}

#backLink {
    color: #343a40;
}

.footer a {
    text-decoration: none;
}

#content {
    padding-bottom: 20px;
```

```
        }


  </style>
</head>
<body class='d-flex flex-column min-vh-100'>

<nav class="navbar navbar-expand-md bg-dark navbar-dark">
  <a class="navbar-brand" href="index.php">University of Twente</a>

</nav>



<div class='container'>

      <!--<a  href='#'  onClick='changeState("purpose");'  id='backLink'><p
class='back text-center'><i class="fas fa-chevron-up"></i> Back</p></a>-->



      <nav aria-label="breadcrumb">
        <div style='float: left'><a href='#' id='backLink'><i class="fas fa-
angle-left"></i>      Back</a>         <span    class='text-muted'>|</span>
 </div>
        <ol class="breadcrumb" id='breadcrumb'>
          <li  class="breadcrumb-item  active"  aria-current="page">Travel
Purpose?</li>
        </ol>
      </nav>

      <h1 id='question'>Welcome to the Travel Check!</h1>
      <br />
</div>


<div class="container" id='content'>

</div>

<footer class="mt-auto footer" style='background-color: #35383d;'>
<div class='container'>
      <div class='row' >
            <div class='col-sm-12'>
            <h5>RELEVANT LINKS</h5><br>
            </div>

            <div class='col-sm-4'>
                <a       href="https://www.utwente.nl/en/sustainability/"
style='color:  white;'  target='blank'>Sustainability  at  University  of
Twente</a><br>
                <a href="https://www.utwente.nl/en/sustainability/carbon-
footprint/" style='color: white;' target='blank'>Carbon Footprint</a><br>
                <a
href="https://www.utwente.nl/en/sustainability/initiatives/mobility/"
style='color: white;' target='blank'>Mobility</a><br>
            </div>
      </div>
</div>
<div class='copyright text-center'>
```

```html
&copy;  2021  -  <a  href='https://utwente.nl/en'  style='color:  white;'
target='blank'>University of Twente</a>
</div>
</footer>



<div class="modal fade bd-example-modal-lg" tabindex="-1" role="dialog" aria-
labelledby="myLargeModalLabel" aria-hidden="true">
  <div class="modal-dialog modal-lg">
    <div class="modal-content">
      <div class="modal-header">
        <h5 class="modal-title" id="modal_title">Modal title</h5>
        <button  type="button"  class="close"  data-dismiss="modal"  aria-
label="Close">
          <span aria-hidden="true">&times;</span>
        </button>
      </div>
      <div class="modal-body">
            <div class="table-responsive" id='travelTable'>
              <strong>Travel Details</strong><br>
              <p>The following  information  presents an  estimation of travel
duration, CO<sup>2</sup>-emission and the amount of transfers.</p>
              <table class='table'  style='width: 100%;'>
                  <thead><th>Duration</th><th>CO<sup>2</sup>-
emission</th><th>Transfers</th></thead>
                  <tbody>
                      <tr><td          id='tableDuration'>Unknown</td><td
id='tableEmission'>Unknown</td><td id='tableTransfers'>Unknown</td></tr>
                  </tbody>
              </table>
            </div>

            <strong>Relevant Links and Articles</strong><br>
            <div id='linksAndArticleContainer'>

            </div>
      </div>
      <div class="modal-footer">
        <button    type="button"    class="btn    btn-secondary"    data-
dismiss="modal">Close</button>
      </div>
    </div>
  </div>
</div>



<script>
PAGES = <?php echo json_encode($pages); ?>;
DESTINATIONS = <?php echo json_encode($destinations); ?>;
//get a separate, searchable array
DESTINATIONNAMES = [];
for(var i = 0; i<DESTINATIONS.length; i++){
    DESTINATIONNAMES.push(DESTINATIONS[i]['id']       +       "|"       +
DESTINATIONS[i]['destination']);
}


DESTINATION = <?php echo json_encode($_SESSION['destination']); ?>;
```

```
LATITUDE                    =                    parseFloat(<?php                echo
json_encode($_SESSION['location']['latitude']); ?>) || 0;
LONGITUDE                   =                    parseFloat(<?php                echo
json_encode($_SESSION['location']['longitude']); ?>) || 0;

window.onload = function() {
  getStartingPoint();
};
</script>

</body>
</html>
```

admin.php

```php
<?php
session_start();

if(!$_SESSION['loggedIn']){
        header("location: login.php");
}

include("functions.php");
include("queries.php");
$conn = connectToDB();
$pages = getInformationZero($conn, "SELECT * FROM pages ORDER BY title ASC");

?>

<!DOCTYPE html>
<html lang="en">
<head>
  <title>Admin</title>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.min.css">
  <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.5.1/jquery.min.js"></script>
  <script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.16.0/umd/popper.min.js"></script>
  <script src="https://maxcdn.bootstrapcdn.com/bootstrap/4.5.2/js/bootstrap.min.js"></script>
  <script src="js/functions.js"></script>
  <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.15.3/css/all.css" integrity="sha384-SZXxX4whJ79/gErwcOYf+zWLeJdY/qpuqC4cAa9rOGUstPomtqpuNWT9wdPEn2fk" crossorigin="anonymous">
</head>
<body>

<div class="container">
  <h2>Edit page content</h2>
  <form method="POST" action="edit_page.php">
    <div class="form-group">
        <label for="sel1">Select page:</label>
    <select onChange="changeEditFields()" class="form-control" id="pageSelection" name="page">
        <option selected disabled>Select a page</option>
        <option value='new'>New page</option>
                <?php
                foreach($pages as $page){
                        $pageId = $page['id'];
                        $pageTitle = $page['title'];
                        echo "<option value='$pageId'>$pageTitle</option>";
                }
                ?>

    </select>
    <br>
    <label for="title">Edit title:</label>
```

```html
            <input type="title" class="form-control" id="title" placeholder="Enter title" name="title"
style="background-color: lightgrey;">
            <br>
            <label for="question">Edit question:</label>
            <input type="text" class="form-control" id="question" placeholder="Enter question"
name="question">
            <br>
        <label for="html">Edit HTML:</label>
        <textarea class="form-control" rows="10" id="html" name="html"></textarea><br>
        <label for="html">Edit breadcrumb:</label>
        <textarea class="form-control" rows="5" id="breadcrumb" name="breadcrumb"></textarea>
            <br>
            <label for="primaryColor">Primary Color:</label>
            <input type="text" class="form-control" id="primaryColor" placeholder="E.g. #123FFF"
name="primaryColor">
            <br>
            <label for="secondaryColor">Secondary Color:</label>
            <input type="text" class="form-control" id="secondaryColor" placeholder="E.g. #123FFF"
name="secondaryColor">
    </div>
    <button type="button" onClick="savePage()" class="btn btn-primary">Save</button> 
    <a id='resultLink' target='blank' href='#'><button type="button" class="btn btn-outline-
secondary">View result <i class="fas fa-external-link-alt"></i></button></a>
    </form>
</div>

<script>
PAGES = <?php echo json_encode($pages); ?>;
</script>

</body>
</html>
```

login.php

```php
<?php
session_start();

include("functions.php");
include("queries.php");

?>
```

```html
<!DOCTYPE html>
<html lang="en">
<head>
  <title>Admin Log In</title>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.min.css">
  <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.5.1/jquery.min.js"></script>
  <script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.16.0/umd/popper.min.js"></script>
  <script src="https://maxcdn.bootstrapcdn.com/bootstrap/4.5.2/js/bootstrap.min.js"></script>
</head>
<body>

<div class="container">
  <div class="row">
    <div class='col'>
        <h2>Admin Log-In</h2>
        <form method="POST" action="logincode.php">
            <div class="form-group">
              <label for="email">Username:</label>
              <input type="text" class="form-control" id="email" placeholder="Enter username" name="username">
            </div>
            <div class="form-group">
              <label for="pwd">Password:</label>
              <input type="password" class="form-control" id="pwd" placeholder="Enter password" name="password">
            </div>
            <button type="submit" class="btn btn-primary">Submit</button>
        </form>
    </div>
  </div>
</div>

</body>
</html>
```

functions.js

```javascript
//global variables
STATE = 'purpose';


CITIES = [
  { id: 0, city: "Other less than 2km", building: "", latitude: 0, longitude:
0 },
  { id: 1, city: "Other less than 7.5km", building: "", latitude: 0,
longitude: 0 },
  { id: 2, city: "Other less than 20km", building: "", latitude: 0, longitude:
0 },
  { id: 3, city: "Other less than 800km", building: "", latitude: 0,
longitude: 0 },
  { id: 4, city: "Other more than 800km", building: "", latitude: 0,
longitude: 0 },
  { id: 5, city: "Enschede", building: "University of Twente", latitude:
52.23835, longitude: 6.85067 },
  { id: 6, city: "Enschede", building: "", latitude: 52.22336, longitude:
6.87060 },
  { id: 7, city: "Dortmund", building: "", latitude: 51.51423 , longitude:
7.46528 },
  { id: 8, city: "London", building: "", latitude: 51.50732, longitude: -
0.12765 },
  { id: 9, city: "Hengelo", building: "", latitude: 52.25232, longitude:
6.79553 },
  { id: 10, city: "New York", building: "", latitude: 40.71273, longitude: -
74.00602 },
];

CATEGORIES = [
  { category: 1, mode1: "walking", mode2: "cycling", mode3: "e-bike", mode4:
"public transport", mode5: "carpooling", mode6: "electric car", mode7: "car"
}, //within 2km
  { category: 2, mode1: "cycling", mode2: "e-bike", mode3: "public
transport", mode4: "carpooling", mode5: "electric car", mode6: "car" },
//within 7.5km
  { category: 3, mode1: "e-bike", mode2: "cycling", mode3: "public
transport", mode4: "carpooling", mode5: "electric car", mode6: "car" },
//within 20km
  { category: 4, mode1: "train", mode2: "plane", mode3: "carpooling", mode4:
"electric car", mode5: "car" }, //more than 20km, within europe and easy by
train
  { category: 5, mode1: "plane", mode2: "train", mode3: "carpooling", mode4:
"electric car", mode5: "car" }, //more than 20km, outside of europe or
difficult by train
];

TRAVELMODES = [
  { name: "walking", prefix: "Go ", icon: "<i class=\"fas fa-walking decision-
icon\"></i>", articles: []},
  { name: "cycling", prefix: "Go ", icon: "<i class=\"fas fa-biking decision-
icon\"></i>" , articles: [
    {title: "Bike Sharing Schemes: The Go About bicycle sharing system lets
you pick up bikes from (and return them to) several locations on campus.",
url: "https://goabout.com/"},
    {title: "Bike Repair Shop: 'De Versnelling'. A place where young people
with an intellectual impairment learn and work under supervision.", url:
"https://swapfiets.nl/en"},
```

```
       {title: "There are fiscal advantages to buy a bike, for bike maintenance
and - under certain conditions - you can opt for a tax exchange for commuting
expenses", url: "https://www.utwente.nl/en/hr/terms-of-employment/optional-
model-for-employment-conditions/#optional-model"},
   ]},
   { name: "e-bike", prefix: "Take the ", icon: "<i class=\"fas fa-bicycle
decision-icon\"></i> <i class=\"fas fa-bolt decision-icon\" style=\"font-
size: 40px; margin: 0px;\"></i>", articles: [
       {title: "If you use your electric bike to commute and would like to
charge it on campus, you can find charging stations for e-bikes in several
bike               parking               facilities",              url:
"https://www.utwente.nl/en/campus/facilities/other-facilities/"}
   ]},
   { name: "public transport", prefix: "Use the ", icon: "<i class=\"fas fa-
bus decision-icon\"></i>", articles: [
       {title: "For commuting, public transport is encouraged.", url:
"https://www.utwente.nl/en/hr/terms-of-employment/commuting-travel-
accommodation/commuting-travel/"}
   ]},
   { name: "train", prefix: "Take the ", icon: "<i class=\"fas fa-train
decision-icon\"></i>", articles: [
       {title: "Work travel by train is facilitated and encouraged by the
provision of an NS Business card.", url: "https://www.utwente.nl/en/hr/terms-
of-employment/business-travel/ns-bc/"},
       {title: "For online bookings with a personal card, go to �Mijn NS
Zakelijk'.", url: "https://www.ns.nl/mijnnszakelijk/login#/"},
       {title: "Before traveling with the business card, read the terms of
use.'", url: "https://www.utwente.nl/en/hr/terms-of-employment/business-
travel/ns-bc/terms-of-use-ns-bc-april2014/"},
       {title: "Plan your journey with NS.'", url: "https://www.ns.nl/en"},
   ]},
   { name: "carpooling", prefix: "Go ", icon: "<i class=\"fas fa-user-plus
decision-icon\"></i>", articles: []},
   { name: "plane", prefix: "Take the ", icon: "<i class=\"fas fa-plane
decision-icon\"></i>", articles: []},
   { name: "electric car", prefix: "Use an ", icon: "<i class=\"fas fa-car-
battery decision-icon\"></i>", articles: [
       {title: "Visit New Motion's website to find out the exact location of
the charging stations, their charging rates and to check which one is
available. ", url: "https://my.newmotion.com/"},
   ]},
   { name: "car", prefix: "Go by ", icon: "<i class=\"fas fa-car decision-
icon\"></i>", articles: []},
]


COLORS = [
  //{ color: "salmonpink", primary_color: "#EBBDA9", secondary_color:
"#fdddcf" },
  { color: "pink", primary_color: "#CF0072", secondary_color: "#f087b5" },
  { color: "purple", primary_color: "#4F2D7F", secondary_color: "#9571ac" },
  { color: "darkblue", primary_color: "#002C5F", secondary_color: "#6374a4"
},
  { color: "blue", primary_color: "#0094B3", secondary_color: "#acd5f2" },
  { color: "lightblue", primary_color: "#63B1E5", secondary_color: "#acd5f2"
},
  { color: "darkgreen", primary_color: "#00675A", secondary_color: "#609791"
},
  { color: "green", primary_color: "#3F9C35", secondary_color: "#95c986" },
  //{ color: "olivegreen", primary_color: "#837703", secondary_color:
"#b4a966" },
```

```javascript
    //{ color: "yellow", primary_color: "#FED100", secondary_color: "#ffee87"
},
   { color: "orange", primary_color: "#EC7A08", secondary_color: "#f3a480" },
   { color: "red", primary_color: "#C60C30", secondary_color: "#ef8473" },
   { color: "winered", primary_color: "#822433", secondary_color: "#d27d81"},
   // { color: "coldgrey", hex: "#616365" },
   // { color: "lightgrey", hex: "#ADAFAF" },
   // { color: "universeblack", hex: "#000000" },
   //{ color: "white", hex: "#FFFFFF" },
   // { color: "warmgrey", hex: "#513C40" },

];

//function that checks current page location on a refresh based on the #...
hash
function getStartingPoint(){
  var hash = window.location.hash.substr(1);

  if(hash) {
        changeState(hash);
  } else {
        changeState('purpose');
  }
}

//function that changes state when an option is clicked
function changeState(newState) {
  STATE = newState;
  changeContent();

  if(newState == "conference_in_person" || newState == "meeting_in_person"
|| newState == "study_trip_options" || newState == "other_in_person" ||
newState == "commuting_in_person") {
        addLocationSpecificData();
  }
}

function addLocationSpecificData() {


      /*
      if(DESTINATION > 4) {
        var destinationLong = destinationInfo['longitude'];
        var destinationLat = destinationInfo['latitude'];

        if(LONGITUDE == 0 && LATITUDE == 0){    //if  no  location  given,
assume that enschede is used
              LONGITUDE = 6.85067;
              LATITUDE = 52.22336;
        }

        var   distanceToDestination   =   distance(LONGITUDE,   LATITUDE,
destinationLong, destinationLat);
      } else {
        if(DESTINATION == 0) {
          var distanceToDestination = 1;
        } else if(DESTINATION == 1) {
          var distanceToDestination = 5;
        } else if(DESTINATION == 2) {
          var distanceToDestination = 10;
        } else if(DESTINATION == 3) {
```

```
            var distanceToDestination = 50;
          } else if(DESTINATION == 4) {
            var distanceToDestination = 1000;
          }
       }

      var categoryNr = determineDestinationCategory(distanceToDestination);

      //get correct category information from array
     var index = findWithAttr(CATEGORIES, 'category', parseInt(categoryNr));
     var category = CATEGORIES[index];

      //assign correct travel modes in correct order
      shuffleArray(COLORS);

    for(var i = 1; i < 6; i++) {
        if(category['mode' + i]) {
            modeDiv = document.getElementById("modeDiv" + i);
            mode = document.getElementById("mode" + i);
            modeRank = document.getElementById("modeRank" + i);

            modeRank.innerHTML = i + ". ";
            mode.innerHTML = category['mode' + i];
            modeDiv.style.backgroundColor = COLORS[i-1]['hex'];
            modeDiv.style.color = "white";

            document.getElementById("prefix"      +      i).innerHTML      =
getPrefix(category['mode' + i]);
            document.getElementById("modeInfo" + i).style.display = "block";
            document.getElementById("mode"  +  i  +  "link").href  =  "#"  +
category['mode' + i];
        }
      }
      */

      //retrieve destination data
      var index = findWithAttr(DESTINATIONS, 'id', parseInt(DESTINATION));
      var destinationInfo = DESTINATIONS[index];


      if(destinationInfo['longitude']  ||  destinationInfo['langitude'])  {
      //travel to destination is dependent on user location
            if(LONGITUDE == 0 && LATITUDE == 0){    //if    no    location
given, assume that enschede is used
                  LONGITUDE = 6.85067;
                  LATITUDE = 52.22336;
            }


          var destinationLong = destinationInfo['longitude'];
          var destinationLat = destinationInfo['latitude'];

          var  distanceToDestination  =  distance(LONGITUDE,  LATITUDE,
destinationLong, destinationLat);

          var                        categoryNr                        =
determineDestinationCategory(distanceToDestination);

        //get correct category information from array
      var      index      =      findWithAttr(CATEGORIES,      'category',
parseInt(categoryNr));
```

```javascript
        var category = CATEGORIES[index];

    } else {
        var category = CATEGORIES[destinationInfo['travel_category']-1];
    }


    for(var i = 1; i < 8; i++) {  //loop through the possible travel modes
        var mode = category['mode' + i];    //get    name    of    each
subsequent travel mode within the category of the destination

        if(mode === undefined){ //break the loop when a category has no
more travel mode options left
            break;
        }else{        //spawn travel modes
            var index = findWithAttr(TRAVELMODES, 'name', mode);
            var modeInfo = TRAVELMODES[index];

            var                          travelModeBox                  =
document.getElementById("travelSuggestions");

            if(mode              ==              "train"              &&
destinationInfo['travel_time_train_minutes'] > 0) {
                if(destinationInfo['co2_train'] > 0){
                    var co2Label = "<span class=\"badge badge-
light\"><i class=\"fas fa-smog\"></i> " + destinationInfo['co2_train'] +
"</span> ";
                } else {
                    var co2Label = "";
                }
                travelModeBox.innerHTML  +=  "<div  class='col-sm-
4'><div class='travel-mode shadow'><h3>" + modeInfo['prefix'] + mode +
"</h3>" + modeInfo['icon'] + "<br><span class=\"badge badge-light\"><i
class=\"fas fa-clock\"></i> " + destinationInfo['travel_time_train'] +
"</span> " + co2Label + "<span class=\"badge badge-light\"><i class=\"fas fa-
exchange-alt\"></i> " + destinationInfo['transfers_train'] + "</span><button
onclick='changeModalContent(\"" + mode + "\")'data-toggle=\"modal\" data-
target=\".bd-example-modal-lg\"   class='btn   decision-bottom   modal-
button'>More  <i class=\"fas fa-plus\"></i></button></div></div>";
            } else if (mode == "plane" &&
destinationInfo['travel_time_plane_minutes'] > 0) {
                travelModeBox.innerHTML  +=  "<div  class='col-sm-
4'><div class='travel-mode shadow'><h3>" + modeInfo['prefix'] + mode +
"</h3>" + modeInfo['icon'] + "<br><span class=\"badge badge-light\"><i
class=\"fas fa-clock\"></i> " + destinationInfo['travel_time_plane'] +
"</span> <span class=\"badge badge-light\"><i class=\"fas fa-smog\"></i> " +
destinationInfo['co2_plane'] + "</span> <span class=\"badge badge-light\"><i
class=\"fas fa-exchange-alt\"></i> " + destinationInfo['transfers_plane'] +
"</span><button  onclick='changeModalContent(\"" + mode + "\")' data-
toggle=\"modal\" data-target=\".bd-example-modal-lg\" class='btn decision-
bottom        modal-button'>More           <i          class=\"fas        fa-
plus\"></i></button></div></div>";
            } else {
                travelModeBox.innerHTML  +=  "<div  class='col-sm-
4'><div class='travel-mode shadow'><h3>" + modeInfo['prefix'] + mode +
"</h3>"       +       modeInfo['icon']       +        "<br><br><button
onclick='changeModalContent(\"" + mode + "\")' class='btn decision-bottom
modal-button'    data-toggle=\"modal\"    data-target=\".bd-example-modal-
lg\">More  <i class=\"fas fa-plus\"></i></button></div></div>";
            }
```

```javascript
          }

      }

      changeColors();
      coloredWord.innerHTML = destinationInfo['destination'];
}

function determineDestinationCategory(distance) {
  var category = 0;

  if(distance <= 2) {
    category = 1;
  } else if(distance <= 7.5) {
      category = 2;
  } else if(distance <= 20) {
      category = 3;
  } else if(distance <= 800) {
      category = 4;
  } else if(distance > 800) {
      category = 5;
  }

  return category;
}

function getPrefix(mode) {

  var prefix = "";

  if(mode == "walking" || mode == "cycling" || mode == "carpooling") {
      prefix = "Go ";
  }else if (mode == "e-bike") {
      prefix = "Use an ";
  }else if (mode == "plane" || mode == "train") {
      prefix = "Take the ";
  }

  return prefix;
}

//function that changes the content based on  the current state
function changeContent() {

  //get divs
  var content = document.getElementById("content");
  var breadcrumb = document.getElementById("breadcrumb");
  var question = document.getElementById("question");


  //get correct page information from array
  var index = findWithAttr(PAGES, 'title', STATE);
  var pageToDisplay = PAGES[index];

  fadeIn(content);
  fadeIn(question);

  //add new page content
  content.innerHTML = pageToDisplay['html'];
  breadcrumb.innerHTML = pageToDisplay['breadcrumb'];
```

```javascript
    question.innerHTML = pageToDisplay['question'];

    //set url for back link
    var hasPreviousState = false;

    var breadcrumbChildren = document.getElementById("breadcrumb").childNodes;
    for(var i = breadcrumbChildren.length-1; i > -1; i--) {

        if(breadcrumbChildren[i].tagName == "LI") {
            if(!breadcrumbChildren[i].classList.contains("active")){
                var index = i;
                hasPreviousState = true;
                break;
            }
        }
    }

    if(hasPreviousState) {
        var                         previousState                  =
breadcrumbChildren[index].getElementsByTagName("a")[0].getAttribute("href")
;
        var backLink = document.getElementById("backLink");

        backLink.href = previousState;
        backLink.setAttribute("onclick","changeState('"                  +
previousState.substr(1) + "');");
    }


    //change color tones based on page
    changeColors();

    fadeOut(content);
    fadeOut(question);

}

function changeColors() {

    shuffleArray(COLORS);

    var coloredWord = document.getElementById("coloredWord");
    coloredWord.style.color = COLORS[0]['primary_color'];

    var decisionTiles = document.getElementsByClassName("decision");
    for(var i=0; i<decisionTiles.length; i++) {
        decisionTiles[i].style.backgroundImage = "linear-gradient(to top, " +
COLORS[0]['primary_color'] + " 50%, white 50%)";
    }

    var decisionBottoms = document.getElementsByClassName("decision-bottom");
    for(var i=0; i<decisionBottoms.length; i++) {
        decisionBottoms[i].style.backgroundColor = COLORS[0]['primary_color'];
    }

    var decisionIcons = document.getElementsByClassName("decision-icon");
    for(var i=0; i<decisionIcons.length; i++) {
        decisionIcons[i].style.color = COLORS[0]['secondary_color'];
    }

}
```

```javascript
function changeModalContent(mode) {
      var destinationInfo = DESTINATIONS[DESTINATION-1];
      var index = findWithAttr(TRAVELMODES, 'name', mode);
      var travelModeInfo = TRAVELMODES[index];
      var articles = travelModeInfo['articles'];

      var tableDuration = document.getElementById("tableDuration");
      var tableEmission = document.getElementById("tableEmission");
      var tableTransfers = document.getElementById("tableTransfers");

      var header = document.getElementById("modal_title");
      header.innerHTML = mode[0].toUpperCase() + mode.substring(1);

      var table = document.getElementById("travelTable");
      var                           articlesContainer                      =
document.getElementById("linksAndArticleContainer");

      //reset divs
      table.style.display = "none";
      articlesContainer.innerHTML = "";

      if(mode == "train" || mode == "plane") {
            table.style.display = "unset";

            tableDuration.innerHTML   =   (destinationInfo['travel_time_'  +
mode]) ? destinationInfo['travel_time_' + mode] : "Unknown";
            tableEmission.innerHTML  =  (destinationInfo['co2_'  +  mode])  ?
destinationInfo['co2_' + mode] : "Unknown";
            tableTransfers.innerHTML   =   (destinationInfo['transfers_'  +
mode]) ? destinationInfo['transfers_' + mode] : "Unknown";

      }

      if(articles.length > 0){
            for(var i = 0; i<articles.length; i++){
               articlesContainer.innerHTML      +=      "<a      href='"      +
articles[i]['url']  +  "'  target='blank'><div  class='card  bg-light  text-
dark'><div class='card-body'>" + articles[i]['title'] + "</div></div></a>";
            }
      } else {
            articlesContainer.innerHTML += "<br><p>No articles found.</p>";
      }


      console.log(mode);
      console.log(DESTINATION);
      console.log(DESTINATIONS[DESTINATION-1]);
}

//function that serves destination suggestions based on input
function recommendDestination(){
      var container = document.getElementById("destinationContainer");
      var destination = document.getElementById("destination");

      //resetting values
      container.innerHTML = "";
      destination.classList.remove("is-valid");
      showNextButton(0);
```

```javascript
        if(destination.value){
              let a = DESTINATIONNAMES;
              var term = destination.value;
              var search = new RegExp(term , 'i'); // prepare a regex object
              let b = a.filter(item => search.test(item));
              var c = b.slice(0,6);

              if(c.length > 0) {
                    for(var j = 0; j<c.length; j++){
                       var suggestion = document.createElement("li");
                       var full = c[j].split("|");

                       suggestion.innerHTML = full[1];
                       suggestion.className = "list-group-item";
                       suggestion.id = full[0];
                       suggestion.onclick = function(){
                           destinationSelected(this.id, this.innerHTML)
                       };
                       container.appendChild(suggestion);
                    }
              } else {
                    var suggestion = document.createElement("li");
                    suggestion.innerHTML = "No destinations found...";
                    suggestion.className = "list-group-item disabled-look";
                    container.appendChild(suggestion);
              }


              /*
              //add default options
              for(var k = 0; k<5; k++){
                var suggestion = document.createElement("li");
                suggestion.innerHTML = DESTINATIONS[k]['city'];
                suggestion.className = "list-group-item";
                suggestion.id = DESTINATIONS[k]['id'];
                suggestion.onclick = function(){
                    destinationSelected(this.id, this.innerHTML.toString())
                };
                container.appendChild(suggestion);
              }*/

        }
}

function destinationSelected(id, city){
      var container = document.getElementById("destinationContainer");
      var destination = document.getElementById("destination");

      if(container){
            container.innerHTML = ""; //removes the suggestions
            destination.value = city;
            destination.classList.add("is-valid");

            showNextButton(1);
      }

      DESTINATION = id;
      storeDestinationInSession();
}
```

```javascript
function changeEditFields() {
      var select = document.getElementById("pageSelection");
      var id = select.value;
      var link = document.getElementById("resultLink");
      var title = document.getElementById("title");
      var question = document.getElementById("question");
      var html = document.getElementById("html");
      var breadcrumb = document.getElementById("breadcrumb");
      var primaryColor = document.getElementById("primaryColor");
      var secondaryColor = document.getElementById("secondaryColor");


      if(id == 'new'){
            title.value = "";

            question.style.display = "none";
            html.style.display = "none";
            breadcrumb.style.display = "none";
            link.style.display = "none";
            primaryColor.style.display = "none";
            secondaryColor.style.display = "none";
      }else{

            question.style.display = "block";
            html.style.display = "block";
            breadcrumb.style.display = "block";
            link.style.display = "block";
            primaryColor.style.display = "block";
            secondaryColor.style.display = "block";

            var index = findWithAttr(PAGES, 'id', parseInt(id));
            var pageToDisplay = PAGES[index];

            title.value = PAGES[index]['title'];
            question.value = PAGES[index]['question'];
            html.value = PAGES[index]['html'];
            breadcrumb.value = PAGES[index]['breadcrumb'];
            primaryColor.value = PAGES[index]['primary_color'];
            secondaryColor.value = PAGES[index]['secondary_color'];
            link.href = "index.php#" + title.value;
      }



}

function savePage() {
      var id = document.getElementById("pageSelection").value;
      var title = document.getElementById("title").value;


      if(id == 'new'){  //create new page
            sendVariables  =  "function=createPage&title="  +  title  +
"&question=" + question;
            ajaxRequest("db_insertion.php", sendVariables, pageCreated, []);
      }else{
            var question = document.getElementById("question").value;
            var html = document.getElementById("html").value;
            var breadcrumb = document.getElementById("breadcrumb").value;
            var link = document.getElementById("resultLink");
```

```javascript
            var                         primaryColor                    =
document.getElementById("primaryColor").value;
            var                        secondaryColor                   =
document.getElementById("secondaryColor").value;
            link.href = "index.php#" + title;

            sendVariables = "function=savePage&id=" + id + "&title=" + title
+ "&question=" + question + "&html=" + html + "&breadcrumb=" + breadcrumb +
"&primaryColor=" + primaryColor + "&secondaryColor=" + secondaryColor;
            ajaxRequest("db_insertion.php", sendVariables, pageSaved, []);
        }



    }

function storeDestinationInSession() {
        sendVariables = "function=storeDestinationInSession&destinationId=" +
DESTINATION;
        ajaxRequest("store_session.php", sendVariables, pageSaved, []);
}

function storeLocationInSession() {
        sendVariables   =   "function=storeLocationInSession&longitude="   +
LONGITUDE + "&latitude=" + LATITUDE;
        ajaxRequest("store_session.php", sendVariables, pageSaved, []);
}

function pageSaved() {

}

function pageCreated() {
        window.location.href = "admin.php";
}

function ajaxRequest(file, sendVariables, successFunction, args){
        let xmlhttp= window.XMLHttpRequest ?
        new XMLHttpRequest() : new ActiveXObject("Microsoft.XMLHTTP");


        xmlhttp.onreadystatechange = function() {
                if (this.readyState === 4 && this.status === 200)
                        console.log(this.responseText); // Here is the response
                response = this.responseText;

                if(response === "success"){
                        successFunction.apply(this, args);
                }else if(response.length > 0){
                        alert("Something went wrong");
                }
        }

        xmlhttp.open("POST",file,true);
        xmlhttp.setRequestHeader("Content-type","application/x-www-form-
urlencoded");
        xmlhttp.send(sendVariables);
}


//function to search through array
```

```javascript
function findWithAttr(array, attr, value) {
    for(var i = 0; i < array.length; i += 1) {
        if(array[i][attr] === value) {
            return i;
        }
    }
    return -1;
}

function showNextButton(show) {
  var button = document.getElementById("nextButton");
  var buttonContainer = document.getElementById("nextButtonContainer");
  var nextLink = document.getElementById("nextLink").getAttribute("href");

  if(show){
        button.disabled = false;
        buttonContainer.classList.remove("disabled-look");
        buttonContainer.setAttribute("onclick","changeState('"          +
nextLink.substr(1) + "'); setHash('" + nextLink + "')");
  }else{
        button.disabled = true;
        buttonContainer.classList.add("disabled-look");
        buttonContainer.removeAttribute("onclick");
  }
}

function setHash(hash) {
  window.location.hash = hash;
}

//add fadein and fadeout effects
function fadeIn(x) {
  x.classList.remove("fadein");
  x.classList.add("fadeout");
}

//add fadein and fadeout effects
function fadeOut(x) {
  x.classList.remove("fadeout");
  x.classList.add("fadein");
}

document.addEventListener('keydown', e => {
  if (e.ctrlKey && e.key === 's') {
    // Prevent the Save dialog to open
    e.preventDefault();
    // Place your code here
    savePage();
  }
});

function getLocation() {
  var button = document.getElementById("locationButton");
  button.innerHTML = "Retrieving... <span class=\"spinner-border spinner-border-sm\"></span>";

  if (navigator.geolocation) {
    navigator.geolocation.getCurrentPosition(showPosition);
  } else {
    button.innerHTML = "Failed to retrieve";
      button.disabled = true;
```

```javascript
    }
  }

  function showPosition(position) {
    LATITUDE = position.coords.latitude;
    LONGITUDE = position.coords.longitude;

    var button = document.getElementById("locationButton");
    button.innerHTML = "Retrieved";

    storeLocationInSession();
    button.disabled = true;


  }

  function distance(lon1, lat1, lon2, lat2) {
    var R = 6371; // Radius of the earth in km
    var dLat = (lat2-lat1).toRad();  // Javascript functions in radians
    var dLon = (lon2-lon1).toRad();
    var a = Math.sin(dLat/2) * Math.sin(dLat/2) +
            Math.cos(lat1.toRad()) * Math.cos(lat2.toRad()) *
            Math.sin(dLon/2) * Math.sin(dLon/2);
    var c = 2 * Math.atan2(Math.sqrt(a), Math.sqrt(1-a));
    var d = R * c; // Distance in km
    return d;
  }

  /* Converts numeric degrees to radians */
  if (typeof(Number.prototype.toRad) === "undefined") {
    Number.prototype.toRad = function() {
      return this * Math.PI / 180;
    }
  }

  function shuffleArray(array) {
      for (let i = array.length - 1; i > 0; i--) {
          const j = Math.floor(Math.random() * (i + 1));
          [array[i], array[j]] = [array[j], array[i]];
      }
  }
```

functions.php

```php
<?php

function connectToDB(){
        $servername = "localhost";
        $dbusername = "...";
        $dbpassword = "...";
        $dbname = "... ";

        // Create connection
        $conn = new mysqli($servername, $dbusername, $dbpassword, $dbname);
        // Check connection
        if ($conn->connect_error) {
                die("Connection failed: " . $conn->connect_error);
        }// END OF REATING CONNECTION

        $conn->query('set character_set_client=utf8');
        $conn->query('set character_set_connection=utf8');
        $conn->query('set character_set_results=utf8');
        $conn->query('set character_set_server=utf8');

        return $conn;
}

?>
```

db_insertion.php

```php
<?php
session_start();

if(!$_SESSION['loggedIn']) {
  header("location:login.php");
}

include("queries.php");
include("functions.php");

$conn = connectToDB();

$functionToExecute = $_POST['function'];

if($functionToExecute == "savePage"){
        $pageId = $_POST['id'];
        $title = $_POST['title'];
        $question = $_POST['question'];
        $html = $_POST['html'];
        $breadcrumb = $_POST['breadcrumb'];
        $primaryColor = $_POST['primaryColor'];
        $secondaryColor = $_POST['secondaryColor'];

        if(updatePage($conn, $pageId, $title, $question, $html, $breadcrumb,
$primaryColor, $secondaryColor)) {
                echo "success";
        }else{
                echo $_SESSION['databaseError'];
        }

}

if($functionToExecute == "createPage"){
        $title = $_POST['title'];

        if(createPage($conn, $title)) {
                echo "success";
        }else{
                echo $_SESSION['databaseError'];
        }

}


?>
```

logincode.php

```php
<?php
session_start();

if($_SESSION['loggedIn']){
        header("location: admin.php");
}

//entered credentials
$username = $_POST['username'];
$password = $_POST['password'];

$correctUsername = "...";
$correctPassword = "...";

if($username == $correctUsername && $password == $correctPassword){
        $_SESSION['loggedIn'] = True;
        $redirect = "admin.php";
}else{
        $_SESSION['loggedIn'] = False;
        $redirect = "login.php?error=auth";
}

header("location: $redirect");


?>
```

queries.php

```php
<?php
function getInformationZero($conn, $query){

    $stmt = $conn->prepare($query);
    $stmt->execute();

    $data = $stmt->get_result()->fetch_all(MYSQLI_ASSOC);

    return $data;
}

function getInformationSingle($conn, $query, $dataType, $input){

    $stmt = $conn->prepare($query);
    $stmt->bind_param($dataType, $input);

    $stmt->execute();

    $data = $stmt->get_result()->fetch_all(MYSQLI_ASSOC);

    return $data;
}

function getInformationDouble($conn, $query, $dataType, $input1, $input2){
    $stmt = $conn->prepare($query);

    $stmt->bind_param($dataType, $input1, $input2);

    $stmt->execute();

    $data = $stmt->get_result()->fetch_all(MYSQLI_ASSOC);

    return $data;
}

function getInformationTriple($conn, $query, $dataType, $input1, $input2, $input3){

    $stmt = $conn->prepare($query);
    $stmt->bind_param($dataType, $input1, $input2, $input3);

    $stmt->execute();

    $data = $stmt->get_result()->fetch_all(MYSQLI_ASSOC);

    return $data;
}

function getInformationQuadruple($conn, $query, $dataType, $input1, $input2, $input3, $input4){

    $stmt = $conn->prepare($query);
    $stmt->bind_param($dataType, $input1, $input2, $input3, $input4);

    $stmt->execute();

    $data = $stmt->get_result()->fetch_all(MYSQLI_ASSOC);
```

```php
        return $data;
}



//update
function   updatePage($conn,   $pageId,   $title,   $question,   $html,   $breadcrumb,
$primaryColor, $secondaryColor){
    // prepare and bind
    $stmt = $conn->prepare("UPDATE pages SET title = ?, question = ?, html = ?,
breadcrumb = ?, primary_color = ?, secondary_color = ? WHERE id = ?");
    $stmt->bind_param("ssssssi",    $title,    $question,    $html,    $breadcrumb,
$primaryColor, $secondaryColor, $pageId);

    if($stmt->execute()){
        return True;
    }else{
        $_SESSION['databaseError'] = $stmt->error;
        return False;
    }
}

//insert

function createPage($conn, $title){
    $stmt = $conn->prepare("INSERT INTO pages (title) VALUES (?)");
    $stmt->bind_param("s", $title);

    if($stmt->execute()){
        return True;
    }else{
        $_SESSION['databaseError'] = $stmt->error;
        return False;
    }
}


?>
```

store_session.php

```php
<?php
session_start();

$functionToExecute = $_POST['function'];

if($functionToExecute == "storeDestinationInSession"){
    $destinationId = $_POST['destinationId'];
    $_SESSION['destination'] = $destinationId;

    echo "success";
}

if($functionToExecute == "storeLocationInSession"){
    $longitude = $_POST['longitude'];
    $latitude = $_POST['latitude'];
    $_SESSION['location']  =  array("latitude"  =>  $latitude,  "longitude"  =>
$longitude);

    echo "success";
}
```