S H A P E S

Smart and Health Ageing through People Engaging in supportive Systems

D2.2 – Accessing Physical Spaces

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Table 1: Revision History

Revision #	Date	Editor	Comments
0.1	20/07/2021	AELTD	Establishing table of contents and inclusion of

				relevant information within several sections
0.2	15/10/2021	AELTD		Included changes from internal review of V0.1
1.0	26/10/2021	AELTD		Final changes for submission

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Table of Acronyms and Abbreviations

Table 3: Acronyms and Abbreviations

Acronym	Full Term
Apps	Mobile applications
T	Task
D	Deliverable
WP	Work package
AELTD Platform	Access Earth Platform
EU	European Union
GP	General Practitioner
H&C	Health and Comfort
IoT	Internet of Things
NUIM	National University of Ireland Maynooth
TP	Technological Platform

WP	Work Package
AI	Artificial Intelligence
PWA	Progressive Web Application

Keywords

PERSONAS, USE CASES, OLDER ADULTS, PRIMARY CARE, ECOSYSTEM, ACCESS, PHYSICAL SPACE, ACCESSIBILITY DATA, DIGITAL INFRASTRUCTURE, MOBILE TECHNOLOGIES

Disclaimer

SHAPES

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Executive Summary

This document is being submitted as the deliverable for T2.2 led by AELTD and associated contributing partners. Accessing Physical Spaces is a key requirement for social inclusion and social participation, as well as for instrumental daily activities. Task 2.2 focuses on access to public physical spaces required to provide physically accessible public space, inclusive of older individuals with varying impairments.

This has been done by the use of an existing platform created by AELTD and modified for the purposes of the SHAPES project. The changes and updates to this platform were informed by research, analysis and interviews conducted as part of this task's deliverable.

Contained within this document you will find the key technological and user interface changes as well as the frame work for its inclusion and deployment within SHAPES pilot sites. These changes and strategies have been user led and informed by the involvement of targeted demographic participation to ensure the most impactful data is being gathered and presented in the most impactful manner.

The key result from this report is a fully functional tool kit allowing anyone to map the built environment and the confirmation of the assumption that the availability of accessible data is key for everyone to successfully be able to access their physical spaces.

1 Introduction

1.1   Overview of deliverable

T2.2, Accessing Physical Spaces, is a key requirement for social inclusion and social participation, as well as for instrumental daily activities. This task focuses on the access to public physical spaces required to provide physically accessible public spaces inclusive of older individuals with varying impairments. This task has engaged local community members, namely older individuals in collectively mapping accessibility in their own locality in a barrier-free, secure and enabling perspective, noting barriers in terms of physical accessibility, gaps and suggestions for improvement, also considering a differentiated gender approach and the ways in which local communities address these challenges, affording an opportunity for communities across Europe to learn from each other through the SHAPES Platform. Combining increased community awareness with activism, this task uses the SHAPES Ecosystem and contributes to building a more detailed interactive digital platform, which acts as a guide and as a resource to highlight spaces or areas that are accessible.

This report reviews the processes behind the creation of a digitally available platform for the purposes of examining and recording public physical spaces, establishing their accessibility for older individuals, while highlighting their participation within the data gathering and feature improvement processes.

1.1.1 Deliverable objectives

The objectives for WP2 are:

- To understand the broader and different context of the lives of older individuals.
- To create more accessible public physical pathways in our social spaces.
- To create more accessible private houses and more age-friendly attitudes.
- To identify ways of empowering older individuals to actively engage with their care networks and setting.
- To identify the user-centred requirements for the SHAPES Platform.

T2.2's main goal is to establish actionable information on how to develop a digital platform with the older individual's needs at its core consideration and involvement for use within the SHAPES eco system, to help meet the above listed objectives. This document will outline the processes, assumptions and actions required in order to achieve this purpose.

1.1.2 Key inputs and outputs

The main inputs for this deliverable consisted of partner lead interviews and assessments from other SHAPES partners as either relevant extracts from other project deliverables or as direct work specifically conducted for T2.2's deliverable, as well as

further independent research and interviews conducted by the AELTD team both prior to and during the lifetime of the SHAPES project.

The information gathered, studied and analysis performed lead to the design decisions and platform changes we will be outlining in this document.

The key outputs for this 2.2 deliverable are the technological improvements already developed, or in the process of being developed, on the Access Earth platform (AELTD Platform), as well as this document outlining the necessary design decisions and thought processes.

1.2   Structure of the document

This document has been broken into sections outlining in detail the various aspects and features which make up Deliverable 2.2.

Section 1, Introduction, provides the overview of the deliverable, highlighting the objectives, inputs and outputs, while also discussing how T2.2 fits within the overall scope of the SHAPES strategic objectives and the interconnections and synergies it has with other tasks and deliverables.

Section 2, Background, details the definitions and descriptions of key technologies used while also describing the history of their development within AELTD and how they were brought together for the purposes of the SHAPES project.

Section 3, Case Studies, goes into the information gathered by AELTD to confirm assumptions on how their data is gathered and highlights feedback that informed the latest design changes to the platform.

Section 4, Personas, Interviews and Technology Connections, goes through the SHAPES Personas from Deliverable 2.7, interview extracts from T2.1 and contributing partner led interviews for T2.2. This section will focus on the inclusion of SHAPES partner research consolidation, highlighting where beneficial insights have been derived for improvements to the Access Earth platform, where existing decisions are supported and referencing how the platform will be directly impacting and benefiting the specific user Persona and individuals that are at heart of the SHAPES project.

Section 5, Technology Development, outlines the redesign and feature changes to the AELTD platform, based on the feedback and analysis from previous sections as well as due to technical requirements necessary for an appositive user experience.

Section 6, Pilot Site Deployment, explains the preparation for the future pilot site AELTD platform will be deployed in and describes the use cases that will be tested and measured for future improvements and upgrades.

This documents also includes sections on Ethical Requirements, Future Plans and a Conclusion with relevant appendices.

1.3 Deliverable Interconnections

This section outlines at a high level the interconnections between T2.2 and other SHAPES tasks and work packages. This section will review these interconnections from both an output and synergistic perspective.

1.3.1 Interconnections of outputs of T2.2 to SHAPES strategic objectives

The development of this deliverable is in accordance with the SHAPES strategic objectives (OBJs). For example, with OBJ 1: To build and deliver the innovative European-led SHAPES Platform, providing a broad range of interoperable solutions to improve the health, well-being and independence of older individuals, while enhancing the long-term sustainability of H&C systems in the EU. The development of this deliverable is a further step towards the fulfilment of this goal through the development of an informed approach to the creation and implementation of a digital platform to promote the independence of older individuals within the physical environment.

Furthermore, the completion of this deliverable also supports the fulfilment of OBJ 2: To create, enlarge and consolidate the SHAPES Ecosystem for active and healthy ageing allowing stakeholders to exchange knowledge and expertise, identify current and future solutions for active and healthy ageing, provide mutual advice, training and support and exploit the collective knowledge for social and commercial purposes. With data sharing and gathering being at the core of the AELTD Platform, this objective would be considered fulfilled on its merit alone. For the AELTD Platform to be deployed successfully workshops and educational materials are shared and performed with participating members which further adds to meeting the goals of this objective.

AELTD are technical leaders for pilot theme PT7-002 and will be deploying the AELTD platform as part of this themes requirements. The work conducted as part of T2.2 has contributed to the preparations for this deployment and the betterment of the platform prior to its pilot site testing and thus supports OBJ 4: To implement the SHAPES Pan-European Pilot Campaign that demonstrates and validates the Platform in 36 pilot activities in 15 interconnected communities or pilot sites across 11 EU Members States (MS). Informed by these pilots, the roll out of SHAPES across Europe will positively affect the lives of millions of Europeans.

T2.2 proactively researches, develops and analysis the improvement of the AELTD system and its deployment, in part, through the involvement and participation of individuals who could be considered potential SHAPES platform users. Through this improvement process of the AELTD platform the name and profile of SHAPES is improved and spread thus contributing to OBJ 8: To implement SHAPES wide dissemination reach across Europe, and to turn the Platform into a global reference for active, healthy and independent ageing.

1.3.2 Interdependencies and synergies of T2.2 with other SHAPES actions

T2.1: Understanding Older People: Lives, Communities and Contexts led by NUIM performed in-depth, ethnographic interviews which included examples of a lack in physical accessibility experienced by the interviewees on how their personal lives have been affected by inaccessible locations and the associated anxieties felt as a result. In section 4.2.1 these interview extracts are examined and their influence over the T2.2 deliverable are discussed further. (Silverman, 2006)

T2.5: SHAPES Personas and Use Cases led by UP show the most common challenges older adults face in their day to day lives. The aim was to represent the nature of the challenges faced by advanced aged peoples in order to understand and address them. Section 4.1 of this documents explores the relation these personas have had on the AELTD platform and its ability to address, mitigate and be mindful of these issues.

2. Background

2.1 Definitions

Crowd sourcing is the term used for the outsourcing of certain tasks to the wider public, often via online or by mobile technologies. For the purposes of this project, crowd sourcing, is referencing any users of the Access Earth mobile application to contribute or verify information on the AELTD platform. (Brabham, 2013)

Data gathering is the act of collecting data for storage, analysis, or presentation within the AELTD platform.

Interactive map plugin is one visual component of the AELTD platform. This is the visual layer of the AELTD system for users who wish to view the accessibility data within their specific area that has been gathered by the AELTD platform through the Access Earth mobile application.

Access Earth Mobile Application refers to the mobile software available on Android, iOS and progressive we application for the gathering of data into the AELTD platform.

AELTD Platform refers to the interactive map and mobile application in unison. The Access Earth mobile application is used for data gathering and the interactive plugin is used for the displaying of said information in a more interactive and detailed manner for specific deployment sites.

2.2 Technology used

In this section we will be discussing the various technology components that are used within the AELTD Platform. Starting with an overview of the platform itself and its role within the SHAPES ecosystem. The next sections deal with defining the crowd sourcing app as well as leading into the AI parking analysis tool before finally detailing how the interactive map plugin will integrate within the SHAPES platform as a whole.

2.2.1 Technology overview

The AELTD Platform consists of three distinct yet interconnected systems of technology.

These three systems all interact with and are connected to the same single centralised data base.

These technologies are (1) interactive crowdsourcing mobile app for individuals, (2) Artificial Intelligence, AI, to review satellite/above ground image data and (3) interactive web plugin to display all necessary information for a deployment site. The graphic below shows how these different aspects of the platform interact:
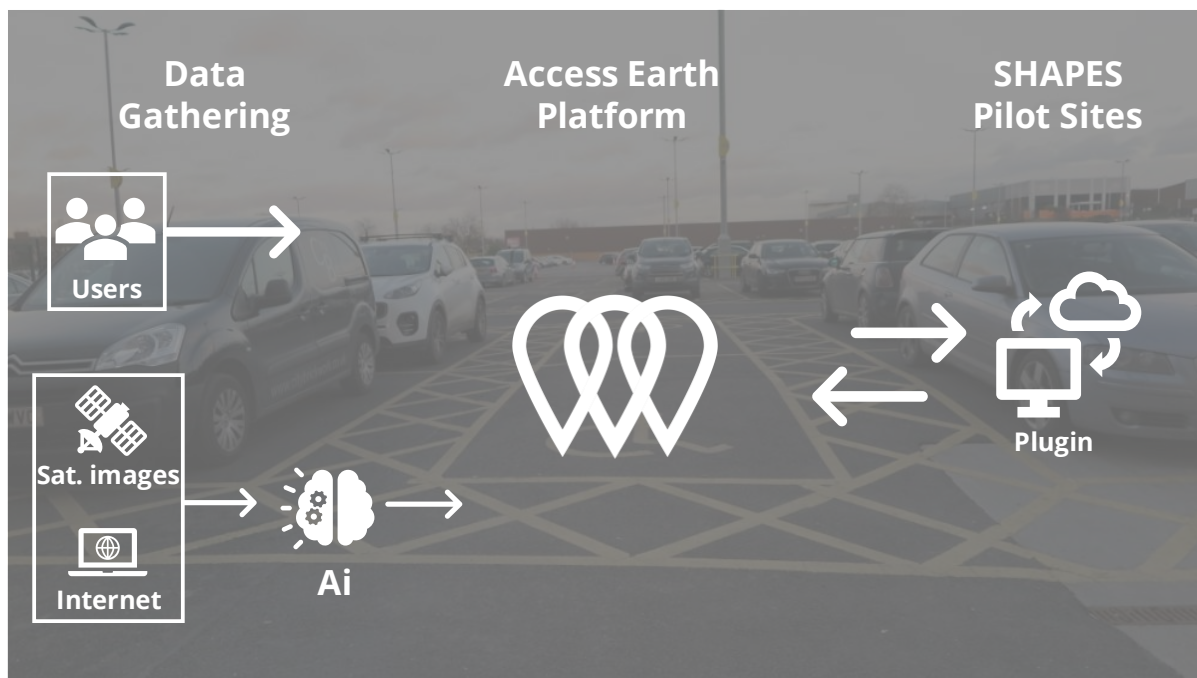
Figure 1 Access Earth Platform overview

Access Earth is a global platform that uses smart AI and crowd sourced data gathering methods to provide the world with details on the accessibility assets within local bars, restaurants, shops, and other businesses venues.

The Access Earth mobile and progressive web application serves as a crowd sourced data gathering method for users to view and contribute to this growing data set, while the AI Parking Analysis system uses an AI image classifier to identify accessible assets (e.g. accessible parking spots) within an area from satellite image data. Both systems will be used to target participating partner sites for the gathering of the necessary data for the SHAPES project.

Recently COVID-19 related criteria have been added to the platform for users to also view and contribute to, what social distancing practices are being used by these local establishments, to keep their workers and customers safe during this global pandemic.

This information allows users with accessibility needs or who are immunocompromised the added confidence to engage within their local communities by viewing the information they need before they make their journey.

The information gathered using the Access Earth platform can be deployed and integrated with a live, real-time connection in existing systems through an API or with an interactive plugin for users to view. Alternatively, users can always access the Access Earth application for free on their own personal mobile, tablet or computing devices.

Access Earth's data is stored on the cloud and can be accessed via APIs, interactive plugin that can be deployed on any website or platform required or through the Access Earth application itself.

2.2.2 Crowd sourcing App.
The Access Earth application is built using the Ionic Framework to allow for the ease of development and maintenance of the code base for the multi-platform application (iOS, Android, PWA).

All stakeholders can either operate as data gathers or data viewers for the information that exists within the Access Earth system. Thus, empowering older individuals with further agency in viewing and providing insights on their local community and built environment.

Users of the application can interact and contribute to the data via their personal devices (iPhone, Android Mobile device, or PC browser) or through an interactive plugin.

The level of data gathering for each interested pilot site will be determined by all interested pilot leaders.

The treatment of the data gathering and the importance of data security and privacy are discussed further in section 7 Ethical Requirements. (Falbe, Frederiksen, & Andersen, 2020)

2.2.3 AI parking analysis.
The AI parking analysis system takes in above ground image data (satellite images, aerial photography, drones, etc.) and passes it through an AI image classifier to identify key points for inclusion into the Access Earth platforms data set. For the purposes of the SHAPES project, Access Earth will be deploying this AI feature to identify accessible parking within interested pilot sites. Section 5 expands further on this feature. (Cyganek, 2013)

2.2.4 Plugin/interactive map
The Interactive plugin consists of two key components that need to be understood.

The first is the web component term plugin, which for the purposes of this project can be described as a web-based piece of technology that can be easily inserted into any webpage and layout. This feature was decided for ease of deploy-ability for any future SHAPES clients that would require an integration of this system into any pre-existing platforms or websites. (Pickering, 2019)

The second is the interactive map component of the plugin. The information for a designated area is show as a map with key points and places of interested represented as an overlay atop the areas map. Users of the plugin can click into these pieces and see additional information as it is available. In addition to this a dashboard within the platform provides users with the ability to view analytic tools and charts to best review the accessible landscape as whole and on average.

2.3 Mapping events

Technology is only as good as its use and implementation. The integration of AELTD platform can only make lasting and meaningful change within a community if it integrates itself within the community it wishes to be adopted by. Community focus and lead adoption is crucial for the successful engagement by local businesses and people for the true benefit in this digital infrastructure investment to be actualised.

Mapping events organised around the Access Earth crowd sourcing mobile application are the ideal conduit to engage targeted deployment locations to engage with key local stakeholder groups and empower the community with agency and ownership of the platform.

These mapping events involve a combination of workshops, promotional campaigns and days of action, involving local businesses, local accessibility champions and other community groups. Contacting these stakeholders for participation and involvement within the lead up to the deployment is a crucial first step to this process.

Mapping events can be run over the course of several hours, on a single day or over the course of a week/month depending on the needs of the area. Prior to the desired start date agreed upon by stakeholders, an information and promotional campaigns is conducted to ask local citizenry to participate in information workshops about the up-and-coming mapping event. A combination of local and digital media advertising targeting the specific community and its surrounding area is advised to maximise visibility and increase attendance on these days.

The workshops will focus on explaining the importance of accessibility information and its ability to empower individuals, the difficulties surrounding existing methods of finds this data and finally a presentation on how the AELTD platform can be used to help provide this valuable information to those who need it most.

During the campaign itself, participants go out into their community visiting their favorite establishments, cafes, restaurants, and shops adding data to the AELTD platform where it is aggregated and presented to its users.

Individuals who have attended the previous workshops will be at an advantage when it comes to identifying key assets to record over those who were not able to attend. However due to the intuitive manner in which the AELTD platform has been constructed, participants who are not accessibility experts that did not benefit from the workshop will be still able to navigate the platform and contribute to the mapping event.

Post event workshops involve the celebration of the community event with the distribution of key facts and figures as to the success of the event, the number of new locations added to the platform and number of new users onboarded etc.

Previous mapping events conducted by AELTD and their relative learnings will be explored further in Section 3 Historical Mapping Events & Information Gathering Sessions.

COVID-19 required additional changes to the AELTD platform as well as a new approach around how best to organised mapping events. These topics are covered further in Sections 3 and 5, of this document.

3 Historical Mapping Events & Information Gathering Sessions

This section will explain and give examples of historic mapping events used by the AELTD platform prior to participation within the SHAPES consortium. Following on from these historic mapping events, the next section will detail how the unique SHAPES user requirements led to AELTD developing and running a series of user led design and feedback sessions.

The Philadelphia case study at the end of this section details this approach and how the learnings from these initial sessions of user feedback led to a more nuanced approach to help guide the OMNITOR user led interview sessions in as well as how best to garner and distill the information provided by the WFDB interview extracts, as further discussed in Section 4 Interviews, Personas and Technology Connections. The results of which has led into actionable insights that are detailed in section 5 Technology Development.

3.1 Historic mapping events

AELTD have carried out mapping events in multiple site across Europe and America. This section will give a brief overview of each mapping event and the key outputs from these events. This section will conclude with the challenges faced due to COVID-19 to the organisation and execution of mapping events and the approach changes wished to be explored for the Philadelphia 2020 mapping event to assess.

3.1.1 Philadelphia 2017 mapping event

In March 2017 an occupational therapist based in Philadelphia contacted AELTD about using their platform to perform a local audit of the built environment within Philadelphia.

Local volunteers reviewed 800 places during the event using the Access Earth mobile app. Now, a year later, the number of places rated on the app is over 1,700. It is evident that the community is considering accessibility when exploring the city like never before.

The people of Philadelphia brought about significant cultural change in the city as a result of this AELTD mapping event. By utilising Access Earth for their campaign was the catalyst that has put accessibility at the forefront of Philadelphia life.

Figure 2 2017 Philadelphia mapping event

3.1.2 Sofia mapping event

Following on from the Philadelphia event AELTD were asked to provide consultation on the mapping event process for the city of Sofia in 2017 as part of a European funded accessibility project.

AELTD shared learnings of how to run localised mapping events across the city with both local disability activist groups as well as government representatives. These initiatives then took place over a 6-month period which resulted in over 1500 locations being identified as needing improvement within the built environment.

The findings of this report were then presented to the participants, local government and media in order to identify where improvements were to be made within the city.

3.1.3 Celbridge mapping event

Working closely with local accessibility groups has always been a key part of AELTD collaborative network.

Celbridge Access Group (CAG) approached AELTD in 2019 to do an access audit of the village. This manifested in a local mapping event where local businesses were involved to provide prizes to the participants for the most rated places and most added accessible parking spaces with local media helping to promote the event. A total of 164 locations were included on the AELTD platform.

3.1.4 Cork mapping event

While involving the general public and local access groups in crowd sourcing mapping events have always been core to AELTD platforms goals and overall mission, the next

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two case studies focus on involving corporate partners and their role in helping to raise awareness of the physical barriers in the built environment.

Access Earth Limited were engaged by The Musgrave Group to perform a mapping event within Cork City for their employees as a Corporate Social Responsibility event.

This mapping event included the running of an accessibility training workshop to inform participating Musgrave employees on the importance of inclusivity, the challenges faced by individuals with accessibility needs as well as upskilling on how to use the Access Earth application.

The event was run on the selected date on June 14th of 2019. After attending the workshop and a brief health and safety talk, participants walked around pre-planned routes to visit publicly accessible buildings and businesses and record accessibility information using the Access Earth application. This accessibility information is made freely available to the public to view and contribute to.

Once the participants had completed their routes and returned to where the workshop was run, prize were given to the participants who mapped the most locations.

Figure 3 Cork City Mapping event

3.1.5 London mapping event

While part of the AI for Good 2019 Cohort, AELTD were approached by Microsoft UK about running a community mapping event as part of the opening of their new customer experience store in Oxford Circus.

As part of the event AELTD were asked to deliver a training session to the store staff as part of their orientation week for the opening of the store. This training session involved educating the staff on the importance of accessibility, with a particular attention being paid to the criteria used in the AELTD platform.

The event itself took place a week later where the 131 staff had already pre-registered ahead of time and were then divided into different teams to map different areas of London around the Oxford Circus store.

Over three hours the event attendees were able to contribute to over 2000 newly mapped places on the AELTD app platform. Many of which after the event having confessed to knowing nothing about accessibility before the event itself.

Following on from this event AELTD learnings were about the importance of the pre-event training session in order to best raise awareness of the importance of physical accessibility within the community. But also, how to best put that idea across to the general population who do not experience physical barriers to the built environment in their everyday life.

3.1.6 Digital mapping event & COVID-19

COVID-19 added complications to how original mapping events could be run from a practicality and safety perspective.

The uncertainty surrounding lockdown procedures at the start of the pandemic for each country combined with how individual establishments reacted to safe business operations provided a new unique physical barrier to accessing physical spaces. The solution to this and how the AELTD platform was augmented to take this into account and the verification of these changes are discussed further in both sections 3.2 and 4.

To combat the organisational and deployment challenges faced for community led and localised mapping events, it was decided that a new strategy should be implemented and verified ahead of the SHAPES pilot sites deployment to ensure its effectiveness.

This strategy would need to take the communities and participants safety into account while attempting to balance the overall reach and effectiveness of the campaign itself.

This new strategy would be developed and executed as part of a mapping event held within Philadelphia which would also serve as a debuting and testing event for the new COVID-19 requirements and as an overall feedback session.

This new strategy required an increased focus on local business leaders to ensure the safety of their staff, additional focus on digital targeted local advertisements, switching to remote workshops over face-to-face meetings and the exploration of the idea of remote contributions.

This idea of a "digital mapping" event, as opposed to a traditional mapping event, removed the emphasis on people visiting the locations physically before adding accessibility information for them. It highlighted people's ability to contribute based on their familiarity with a location prior to the event for effective data collection and impressed an increased significance on how this information can help people who visit an area they are unfamiliar with.

The hope of this new strategy was to create a robust deployment process which could withstand a global pandemic with limited effects on the overall reach of the campaign.

This strategy was originally designed for the Philadelphia mapping event in mind but was also run on a smaller bases for the Central Remedial Clinic adult services department for further verification on its effectiveness as a strategy. Both events outcomes are discussed further in Section 3.2.

3.2 Information Gathering Session & User Testing

Prior to the development of the current version of the AELTD Platform AELTD conducted a variety of both formal and informal information gathering sessions with members of accessibility organisations and members of the accessibility community.

Participants within these information gathering sessions held international backgrounds, were native and foreign language English speakers either approached Access Earth or were approached by Access Earth to provide their insights on methods to improve the Access Earth platform user experience. Participants either worked within the health/accessibility sector or had a specific accessibility need.

3.2.1 Philadelphia Case Study

Philadelphia interviews and mapping events.

In May of 2021, Access Earth conducted a remote mapping event within the American City of Philadelphia. This event had three main objectives.

1. To test out the new developed Covid 19, "social distancing", information the platform had been adapted to provide.
2. To test out the effectiveness of a remote mapping event can have on an area with limited physical presence by the core team members.
3. To assess the assumptions of the current design decisions from legacy feedback session and to provide the team with a further information gathering opportunity.

Philadelphia was chosen as an ideal location to run said event due to the close relationship held between Access Earth and the local accessibility community within the area.

Local stake holders for both businesses associations and accessible community groups were contacted to see if they wished to engage within the planned remote mapping event. A social media announcement campaign was organised with a start date agreed on for May 2021 and were scheduled to last for one week. Some of the more accessible cafes and restaurants were given window stickers to highlight that they were involved within the mapping event and to highlight that they have been included within the AELTD platform.

Figure 4 Access Earth window sticker with QR code
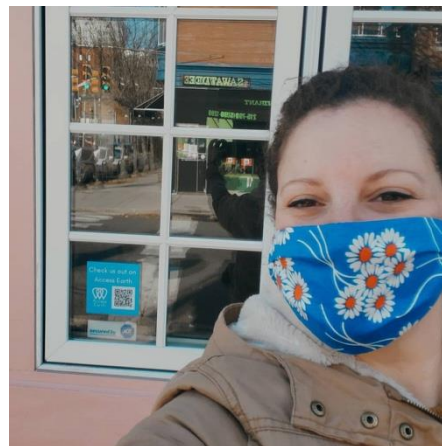
Figure 5 Image of Access Earth window sticker in user

The event successfully managed to increase the Access Earth platform with seven hundred and sixteen new locations and had a pool of users who had participated ready to provide feedback based on their experiences with using the platform to enter these locations social distancing and accessibility related criteria with the Access Earth platforms data gathering capabilities.

Session participants included members with limited mobility, intellectual/cognitive disabilities and/or visual/sensory difficulties. The participants for these feedback sessions included both individuals who have had their accessibility needs since birth and those who have developed them later in life.

The feedback sessions involved participating within a semi-structured group interview conducted over two remote sessions to best accommodate the largest number of participants who desired to be involved. Individuals who were not able to attend but

wished to contribute were given a list of questions to answer and were encouraged to provide any further feedback they desired in written form.

Information gathered relating to sensory (both audio and visual) data were found to be of value from the interviews. It was established early on that providing information relating to sensory assets that were available (brail menus and signage/staff understanding sign language/hearing loops/etc) were useful. It was also discovered, however, to be equally important to also provide information on the details of how bright or noisy the business tends to be.

Individuals who relied on lip reading, sign language or via reading and writing wished to have advanced knowledge of a locations brightness as it tended to be one of their key factors when deciding where to dine out. Similarly, noise had an effect for individuals who relied on non-visual means of navigation or who had made use of a service animal. The increased noise tends to make it difficult navigating if above certain levels and advanced knowledge of quitter locations was considered a positive aspect to consider when determining where to go.

Advanced knowledge of locations noise and brightness levels was also stated as an important factor by participants with cognitive difficulties who were sensitive to sensory stimulation. Areas that had sensory damping equipment for visitors or quite rooms were considered a positive, however advanced knowledge of the baseline levels for a venue was considered very important.

Individuals who made use of seeing eye dogs made the point to express a desire to know locations that allowed comfort animals or other types of service animals within their establishments. Though it is required by law in many countries to allow guide dogs and other types of service animals into a place of business, these participants made the point that most businesses in their experience rarely understood the differences between them. During the interviews we heard from multiple participants how they found locations that allowed comfort animals or were dog friendly were the worst offenders when it came to interfering with their guide dogs when they were performing their job. The disruptions came from over friendly business owners who wished to pet the guide dogs, other animals who were present within the location that wished to interact with the guide dogs or by business owners who had negative experiences with comfort animals due to them not understanding the behavioral differences between the two.

From these sessions it was decided that the inclusion of sensory information for each location (the businesses levels of brightness and noise) needed to be included on the Access Earth platform as it appeared to be an important determining factor in the decision-making process whether a venue was suitable for the respondents needs. These sentiments were further expressed by other respondents to additional interviews carried out by contributing partners (Section 4.2.2), making the inclusion of this details all the more important for inclusion within the Access Earth platform redesign.

In addition to sensory information regarding an establishments lighting and noise levels other accessible assets related to senses were confirmed to be a necessary element for inclusion within the Access Earth platform. These included the availability of hearing loops and the availability of sign language interpreters, the later of which's importance was also furtherer compounded within Section 4.2.1.

Beyond the above-mentioned items, it was also decided to be of merit to include within the platform the ability to whether an establishment is service animal friendly or not so participants can decide to enter or avoid establishments based on this metric due to the experiences expressed by the session participants.

Further to the items discussed regarding the potential improvements to the platform, session participants were also shown a wire frame example for the Access Earth platforms new layout design to garner feedback as to whether it would be an improvement over the original layout design. We asked attendees to consider and focus on the overall user friendliness and accessibility considerations of the designs when giving their answers.
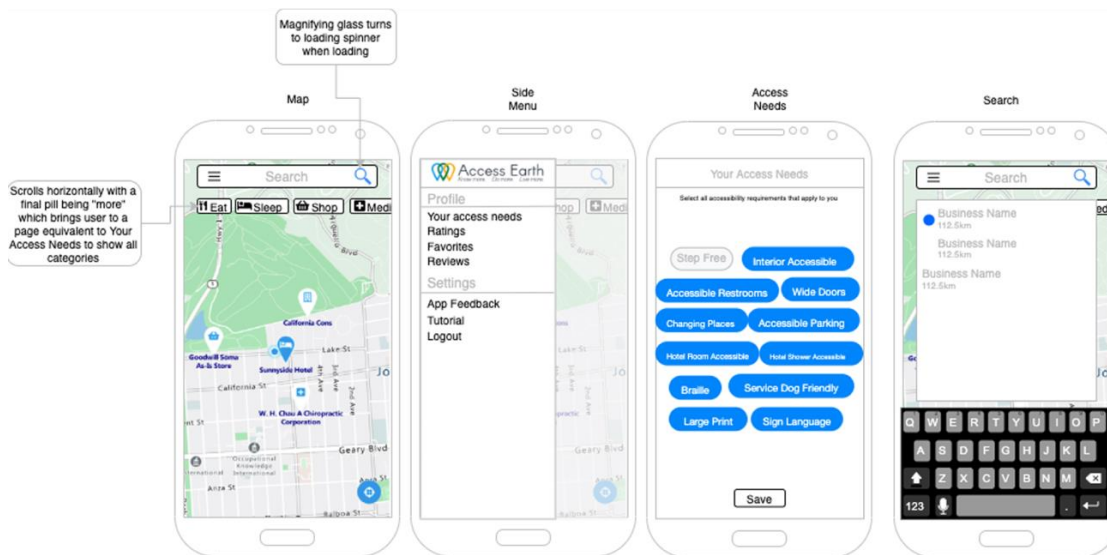
Figure 6 Wireframe of proposed Access Earth platform redesign shown during Philadelphia data information gathering session

Session participants with low to zero visibility stated their preference towards whichever design worked better with screen readers, which worked in favor for the new design layout.

Other participants with limited visibility or other accessibility needs stated they favored the less cluttered design and increased map size. The floating buttons for filtering by categories made the platform more intuitive and easier to navigate while appearing more welcoming.

The "Access Needs" page represented the data presentation portion of the platform and was commented on positively over the original listed format. Additional confidence deciding on this layout design were further compounded through interviews conducted with user groups surrounding the importance of the data being gathered as explored further in section 4.2.2.

To learn more about how the above changes were implemented within the Access Earth platform, see section 5. Technology Development.

3.2.2 Central Remedial Clinic Case Study

AELTD were presented with a further opportunity to test the effectiveness of a digital mapping event in a smaller more limited capacity in September of 2021 when approached by their partner group, the Central Remedial Clinic.

The C.R.C. wished to run an online event for their Adult Services Department as part of an Erasmus+ funded project for their Killester and Clontarf Castle hubs. The event was due to take place a week after AELTD were contacted by the C.R.C. so a full implementation of the digital mapping event strategy was not possible so it was decided to execute a smaller more intimate version and measure the effectiveness based on engagement and participation during campaign itself.

The event included a small fifteen minute talk by an AELTD member on Zoom with participants, detailing what the platform was and how individuals could participate. The whole campaign was due to take place over a two hour period including the onboarding talk and Q&A session.

Participating member included C.R.C. staff members and adults who availed of the C.R.C. services each of whom had varying degrees of Intellectual Disabilities and needs. By the end of the designated time over thirty participants had engaged with the platform adding one hundred and seventeen new locations to the platform.

This event was considered positive from a digital engagement perspective as well as a success regarding the ease of use from the platforms interface perspective.

4 Personas, Interviews and Technology Connections

This section will explore the personas researched by UP, the interviews conducted by OMNITOR as well as the interview extracts by NUIM and will link their influences to the AELTD platform technology solution itself, highlighting how they have informed and impacted design decisions and supported assumptions throughout information gathering sessions and design decision processes.

4.1 Personas

Personas were created as part of T2.5 to show the most common challenges older adults are facing in their lives. The aim was to represent the nature of the older age in order to understand and address challenges. One of the major problem older adults are facing across Europe is accessibility. The opportunity to travel, commute or simply walk around the neighbourhood. To showcase these challenges SHAPES Personas are presented below with their daily challenges and needs to be addressed. (Hjalmarsson, Cronholm, & Gustafsson, 2015)

Each of the personas have been given names since their creation in T2.5 and are presented here with the same names to allow for ease of referral between this task (T2.2) and T2.5. Though many of the needs discussed below can be addressed through the current feature set and data provided by the AELTD platform, it is worth being mindful that there are some needs that are not catered for by these persona descriptions. These uncatered for elements are discussed further in Section 8 of this document.

The first persona, Ernst, is a very active older adult. He likes to exercise, spend time with his wife and he tries to stay included in the society by volunteering work. Moreover, Ernst enjoys annual holidays trip. It is important for Ernst that the space surrounding him is accessible as he sometimes suffers with back and knee pain. Even though, Ernst is still able to drive, going to unknown places is a challenge for him. Luckily, he can use his smartphone to reach new destinations. However, often he is lacking the information about parking spaces. Sometimes, he even refrains from go somewhere knew as he is not sure he would be able to find parking close by.

Roberto, the second persona, is also living with his wife but unlike Ernst, Roberto suffers from multiple health problems (diabetes, high blood pressure). Most importantly, he must stop and catch his breath again while going up the stairs. This has become a challenge for Roberto, and it is stopping him from visiting the town more often. Unless he knows the place, he doesn't go there. Sometimes, the buildings in town are accessible but then they lack an elevator and Roberto is no longer interested in having such a hard time and almost feeling like having a heart attack.

The third person, Ayesha, represents the cohort of older adults that suffer from chronic musculoskeletal disorders, which are one of the most common diseases among older

adults. Ayesha is scared that she will fall again. It is taking away her interest to go out from home. Even though she would love to go out for a walk, to new shops etc., she needs to plan every move and sometimes she spends more time planning than going out to enjoy the trip. She is lacking information about new places – whether they have an entrance for disabled people, whether they are respecting covid-19 rules etc. Also, when going out she plans where to sit and take a break on her way to the destination. It is important for her to know, that she would have a place where to rest as walking is challenging. Due to the lack of ability to move, she is losing touch with her neighbours and family. She would really appreciate some leisure activity close by that she could attend to feel as a part of the community.

The fourth persona, Isabel, has been diagnosed with Alzheimer couple of years ago. Even though she lives alone, she needs support from her son. Due to the cognitive disease Isabel started forgetting things and once she got lost in the city. Isabel would like to go out more often. She would be encouraged if there would be a tracker of her route, so she could easily come back home. Also, information about places she would like to visit should be available for her at any given time as she tends to forget.

Roisin, the fifth persona, struggles with loneliness as she moved to her daughter in the city. Roisin used to live in a village and by moving, she lost contact with all her friends. She would love to experience new places, activities and meet new people in her own age. However, as she doesn't know the city, she is unsure where to go and what to do. Moreover, she feels unsafe in the neighbourhood. She would really appreciate knowing which places are accessible and age-friendly, so she could also informally meet other older adults there. The places should not be noisy either due to Roisin's hearing impairment and she doesn't use hearing aid in public. Noisy places disturb her and create an extra stressor as she can't recognise different sounds and she starts feeling lost. Roisin also enjoys going to church, yet some of them are not accessible, so she has to walk to one 40min away, always accompanied by some family member.

The sixth persona, Jarda, has been facing alcohol addiction for past ten years. As he does not care for his health much, he doesn't visit any doctors despite his health issues. He ends up calling an ambulance when his hearth problems become unbearable. His son would appreciate tracking his father when he gets lost after heavy drinking.

The seventh persona, Helena, who is 93 years old is facing difficulties due to arthrosis. Lately, she experienced multiple falls and accidents at home. She is considering moving to the retirement house. Helena would appreciate knowing more about the surrounding area of the retirement house. If it is possible to go somewhere for a short walk, to have a bench to sit on meanwhile and which places are age-friendly and won't rush her as she needs her time to choose. She doesn't like to rush at all. While staying at her own home, she would love to be more involved in the community. However, most of the places where people are gathering are unreachable for her due to the severity of her arthrosis. Any extra step, stairs, uneven pavements are barrier for her.

Fredrik, the eight personas, is representing the deaf-blind community. Fredrik lives alone and enjoys his independence. He is enjoying going out, yet people are not really aware of his condition and tend to talk to him or even grab him to help. However, Fredrik is not hearing not seeing well and these act of kindness can confuse him on his way to the shop. Fredrik would like to keep on exploring the city, however he doesn't know which of the unfamiliar places are actually accommodated for people with disabilities and which just says so. He would also enjoy raising awareness about deaf blindness as people, not even doctors sometimes, do understand what his conditions entail.

The ninth persona, Astrid, is an informal caregiver of Tessa who is 78 years old. Tessa suffers from Alzheimer's with severe symptoms. Even though she is not able to use internet, Astrid uses it for on-line support. She researches about her mother's conditions and also seeks out for peer support groups. Astrid would appreciate knowing which places are accessible for person with Alzhemier's and the ability to track her mother on her walks. She would like to see her mother going out more to keep her active, yet she is too scared she would get lost easily. Astrid would also appreciate knowing places where support groups or any other activities for patients with Alzheimer's can gather. Daphne, persona number eighteen, is sharing Tessa's needs to keep being involved as a person with Alzhemier's.

Maria, the eleventh persona, is 69 years old widow who enjoys spending time with her friends. They love sharing coffee together with some nice pie Maria prepares. As she is obese and a smoker, climbing upstairs is a real challenge for her. Knowing that certain places are accessible and have an elevator would encourage her to go out and meet her friends in the village. Going out is very important for Maria as three years ago, while suffering from depression, she didn't leave her home for a very long time.

John and Joana, persona twelve, represent a couple of active older adults. They enjoy going out in their neighbourhood. Yet, not all places are pleasant for them enough to visit. They would like to have the opportunity to rate and express when certain places like parks or supermarkets are not accessible for older adults as they encountered many spaces that were impossible to enter due to various challenges in the buildings or on the streets.

Anna, persona number fourteen, is a formal caregiver of her husband – Pekka. Her health is quite well, however taking care of Pekka takes a lot of her energy. She would like to stay active in the society, however she is not able to walk long distances and she doesn't like to go to busy places. Sometimes, she doesn't go out because she is not willing to risk going to places that are not accessible. During the covid-19 pandemic, she was too scared to go out as she didn't know which places are following the restrictions and which ones are just saying they do. Similar needs apply to Elle, persona number sixteen, who is taking care of her 85 years-old husband. As one of her major fears are what would happen to her husband if she would lose the ability to take care of him, she

would like to keep herself healthy and engage in society for as long as possible. Yet, the city they live in is not that accessible as she would need.

The fifteenth persona, Miral, representing a perspective of a refugee is 60 years old. She is still quite active, and she wants to stay that way as long as possible. She is engaged in various activities. Yet, she would like to know about more opportunities and places in her neighbourhood that are organising different sports and social activities for older adults. As she enjoys walks, she would also appreciate some ideas where to go for a nice trip around her apartment.

Nikolas, the seventeenth persona, is representing an 84 years-old man who survived cancer. His wife suffered from stroke couple of years ago. Nowadays both of them are in good health, yet they would like to keep it this way. They both would like to travel much more than they have been so far as they enjoy going for trips very much. Unfortunately, they are not feeling comfortable traveling to places, which they do not know. Having more information about places in terms of their accessibility and age-friendly approach would encourage them to start organising trips again. Also, as the enjoy nature, knowing how accessible touristic' paths are would be an appreciated information.

4.2 Interviews

Interviews were conducted as part of T2.1 and were reviewed to inform design decisions, confirm assumptions, and to better help outline potential future development and opportunities for further utilisation of the Access Earth platform.

Within section 4.2.1 we will be reviewing the extracts from the T2.1 interviews and outlining their relevance for confirmation of assumptions and influences behind elements of feature and design decisions. *Section 8 Future Plans* will include the influences this research has had on the future scope and direction for the continued development of the Access Earth platform. (Abras, Maloney-Krichmar, & Preece, 2004)

In section 4.2.2 we will be analysing the interviews conducted by OMNITOR and link these contributions to the overall assumptions made by data being gathered by the Access Earth platform. *Section 8 Future Plans* will also include potential future development to the platform as a result of these interviews.

4.2.1 Examples of lack of physical accessibility extracted from T2.1 interviews

The interview extracts presented here focus on examples of a lack in accessibility experienced by the interviewees that have impaired their ability to engage within their local environment or has increased their anxiety when considering interacting or navigating the physical environment. Included here are quotes from the respondents on how their personal lives have been affected by these inaccessible locations and the associated issues encountered as a result.

Each person had their own unique perspectives and needs captured through the telling of their own experiences and stories. Below are some individuals of note whose personal stories can be related to the AELTD platform and how it can help, either directly or indirectly, alleviate some of the stresses and barriers experienced by the interviewees. These respondents have been given alias's which match up with the NUIM led T2.1 interviews and are referred to as such throughout this section.

Vicky, who lives with deaf blindness, for example, was hospitalised for a condition unrelated to COVID, but as there were no sign language interpreters available, she was very anxious, nervous and could not understand what was happening or what the medical staff were doing to her.

She was not allowed to go to the doctors on her own, she either had to go with a hearing person or an interpreter, but the latter was inexistent or rarely available, meaning that she would encounter problems accessing healthcare.

She went on to explain other occasions where a disruption to her usual way of interacting with services or an inability to access an interpreter or companion had caused her issues and anxiety while at the employment office or while attending training classes.

These anxieties were continually felt while she attempted to navigate throughout the streets and pavement.

> "Well, sometimes in some parts of the streets there are or the City council places those bollards on the floor which sometimes I do not see. I indeed have hit my leg a few times and I have also seen old people too who have even fallen. Yes, but well, it does not happen very often. But sometimes yes, I have fallen, it is true, or just here down my house where there is like a stone kerb. There is a stone area, I have also stumbled with my feet or my feet have been twisted, to be honest. There are stairs. Yes, here in that square I have occasionally stumbled with the stairs too. Yes, because we have to be careful with that kind of situations, especially with feet, because of the twists but also because of age, it happens also because of my age as I cannot see very well either, so I do not know if that would be the reason why I have that difficulty of vision."

The environment in which Vicky navigates can be at times hostile to her ability to travel throughout safely and comfortably. These issues are only further compounded when it comes to areas that she is not comfortable or familiar with. She goes on to say:

> "I would not dare to go to a new area alone as I do not know what this place is like. [PAUSE] Because I can make a mistake, or something can happen. If there is like a sewer, a place with a pothole, I can fall."

Having advanced knowledge of an area before visiting would be a positive advantage to help inform Vicky of the potential hazards or difficulties she might face while visiting that location. More information available about a location and its available accessibility

assets and potential obstacles for individuals can better help them make relevant preparations and informed decisions about their journey and thus have an increased opportunity to feel more confident and independent. The Access Earth platform would be an ideal tool to better inform Vicky and individuals in similar circumstances for these aforementioned instances. Due to the prevalence of refences to the difficulties and associated anxieties felt by Vick and other respondents from the WFDF interview extract when faced with situations where Sign language interpreters where not present, coupled with their reference from the Philadelphia information gathering sessions (Section 3.2), it was decided that this element should be included as an available criterion for the Access Earth platforms data gathering section.

Alfredo was another interviewee who expressed exasperation and anxiety related to the challenges faced while navigating the built environment.

> "When I go out alone, everything is a barrier. I could not go out completely alone because even if I had some training and I use the cane, it is not easy when you cannot hear. Drivers are not excessively responsible and there are many risks. Then, as I go out quite a lot with my wife, who is in a wheelchair, there are many places in which the wheelchair has many difficulties.... The town has many difficulties, many barriers."

Though the Access Earth platform would not be able to remove these barriers it would be able to provide Alfredo and his wife with additional information regarding the venues and shops they wished to visit while outside their home. Armed with reliable and up to date accessibility information would help alleviate some of the stresses associated with traveling and navigating the built environment while experiencing reduced sensory or mobility needs.

4.2.2 OMNITOR Interviews and Results

Contributing partners OMNITOR reached out within Sweden across two counties, Stockholm and Västerbotten to conduct interviews for further validation of assumptions and future feature development of the AELTD platform based on respondents' answers.

The user profiles, age and accessibility profile, for each of the respondents can be seen below. These interviews took place separate from the interviews conducted in T2.1 and were carried out specifically for the benefit of T2.2.

Interview number #1
Age 85+.
Accessibility profile: Has functional reductions due to age, combined with very poor eyesight.

Interview number #2
Age 78 years old.

Accessibility profile: Has functional reductions due to age. Mainly consider the accessibility problem because they are deaf.

Interview number #3
Age 77 years old.
Accessibility profile: Uses a walker. Believes accessibility is really important now that they are older. For example, there should be lifts and be easy to walk everywhere with walkers.

Interview number #4
Age 85+.
Accessibility profile: Has functional reductions due to age. Believes they can manage themself quite easily.

Interview number #5
Age 85+.
Accessibility profile: Has functional reductions due to age. They mainly use a wheelchair because they have a problem with their balance.

Interview number #6
Age 83 years old.
Accessibility profile: Has functional reductions due to age. They think they can manage themself quite independently. But during COVID pandemic they actively used home deliverance.

Interview number #7
Age 82 years old.
Accessibility profile: Has functional reductions due to age. They think they can manage themself quite independently

Interview number #8
Age 89 years old.
Accessibility profile: Has functional reductions due to age. They think they can manage themself quite independently. They also drive to visit relatives, that live quite far from them.
The interview format included five open ended questions followed by a fifteen-part questionnaire. Please find below the information that was presented to the interviewers and interviewees.

Accessibility Questions
The below list of questions would be ideally answered by interviewees who are advanced in age with some form of accessibility requirement/s.

The questions are open ended to allow the interviewee the ability to provide as detailed of an answer they feel comfortable with. The challenge for the interviewer will be to ensure they can get as comprehensive an answer as possible from the interviewee for each question.

1. What type of information do you look for before heading to a new location you are not familiar with?

2. What type of information do you wish you knew before visiting a new restaurant?

3. What type of information do you wish you knew before visiting a new shop?

4. What type of information do you wish you knew before visiting a new hotel?

5. Do you rely on other people's knowledge of a location that is new to you for key information before you feel comfortable visiting it yourself?

The following information is a list of details currently gathered by the Access Earth platform.

How important is it for you to know the following pieces of information before visiting a new location you are unfamiliar with?

	Very important	*Somewhat important*	*Not important*
Is the entrance to building step free?			
Are the doors to the building 32 inches or wider?			
Is accessible parking available nearby?			
Are bathrooms available.			
Are Accessible bathrooms available?			
Are adult changing stations available?			
Is the interior of the building accessible to navigate around?			
Are Personal Protective Equipment (PPE) offered to customers?			
Are Personal Protective Equipment (PPE) used by staff?			

Are frequently used surfaces cleaned regularly?			
Are social distancing measures in place?			
Are the number of people who can enter this building at one time limited?			
Is a home delivery service available?			
Is a collection service available?			
Are priority opening hours for at risk people available?			

The interview respondents provided us with both their insights into issues they perceived as important when visiting new venues as well as their opinions on the importance of the current data collected by the Access Earth platform.

It was found, as to be expected, that certain data points were more relevant to individuals depending on their own personal accessibility requirements with some varying degree of overlap between items. For example, individuals with mobility requirements (wheelchair users and limited mobility) and individuals with visual impairments found step free entrances either very important or somewhat important, whereas individuals without either of those concerns found these questions to be not important at all.

To highlight the importance of all the items within the list and to encourage positive accessible intersectionality between each of the questions without detracting from any of the items, a design decision was made to move away from the original data presentation and collection format within the Access Earth platform in favour of the new layout design that had also received positive feedback from previous user sessions.

The original data collection format within the Access Earth platform presented the user a list of questions in the same order as the OMNITOR questionnaire asking users YES, NO or Don't Know for each of the specific items.

The presentation format to these questions also appeared in the same order in which they appeared during data collection. For individuals who did not have a vested interest within their answers potentially could feel at worst a sense of marginalisation or de-prioritisation due to this ordering, or at best, a sense of designment and disinterest.
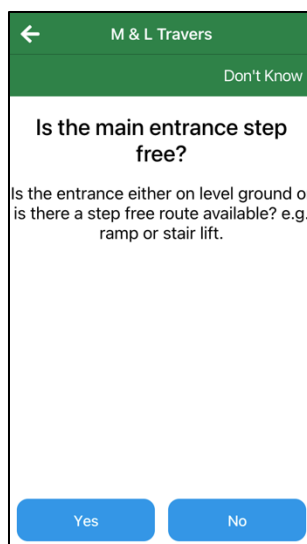
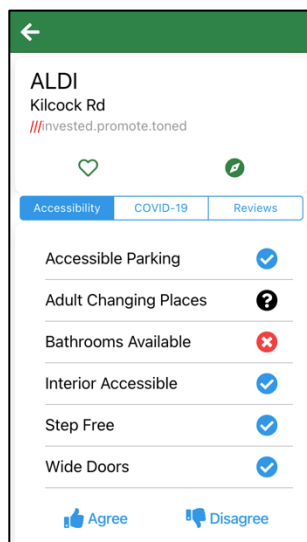*Figure 7 Original Venue Data Collection Format within Access Earth Mobile Platform*

Figure 8 Original Venue Data Presentation Format within Access Earth Mobile Platform

This new format had to show to the users while interacting with the platform for both data collection and presentation no perceived prioritisation between items while also including all data sets.
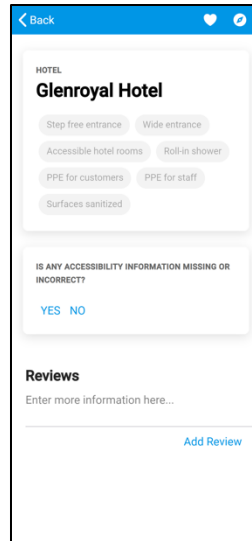
34

Figure 9 New Venue Presentation Format within Access Earth Mobile Platform

This new design layout highlights all options available to the user for both data collection and presentation formats, about a specific venue while immediately showing the most relevant information for the users own personal needs.

Further to this, the new redesign format affords the platform the opportunity to include additional important items without compromising the digital real-estate already taken up by the original data points.

Based on the responses to the open-ended questions involved within the interviews it was decided to add Hand Railings and Accessible Menus into the Access Earth platform.

Lighting and noise levels were also expressed as a positive aspect to note when making decision on venues to visit, especially for dinning out. This further added credence for their inclusion as it supported the information gathered within section 3.2.

These interviews provided further support to the inclusion of COVID-19 information within the platform as it was expressed as both a key concern by a number of respondents when they are considering visiting shops or restaurants. The COVID-19 related questions were also marked "Very Important" by these contributors.

5 Technology Development

The Access Earth platform required a number of UI and feature developments as a result of the numerous feedback sessions held by AELTD, the information gathered from interviews conducted by contributing SHAPES partners as a result of the T2.1 and T2.2 deliverables, changes required to best fit with the established personas and in order to accommodate the changing landscape and shifting requirements due to COVID-19. For further context behind these decisions please review sections 3 and 4.

This section will outline the developments which have taken place on the Access Earth platform throughout the life cycle of T2.2.

5.1 Backend

The Access Earth platform was built originally using an SQL database for information storage and access hosted on Microsoft Azure. After performing scalability and response system checks it was determined that an alternative database system would be required to meet the scalability expectations and the performance requirements determined necessary for a responsive and positive user experience.

To this end, AELTD are migrating their database from SQL to MongoDB with an expected completion date before the end of 2021.

5.2 AI Parking Analysis

We have trained the AI model in object detection to create an image classifier by feeding it with multiple examples of aerial viewed accessible parking data. It can identify if an image it reads contains accessible parking locations and how many of these locations are present within the image. This information can then be added into the Access Earth platform and be made available to all our users and interested stakeholders.

The Irish Wheelchair Association (IWA) is recognised by Local Authorities as the de facto expert in accessibility in Ireland. Further to the IWA access guidelines; where public parking is provided, e.g. in public areas such as shops or offices, a minimum of one, and then one in 15 spaces should be designated for drivers and passengers with disabilities.

Of these designated spaces, one in four should be designed to accommodate large multi-purpose vehicles.

The recommendation is that these 1:4 bays would be of the largest size (5400mm x 7800mm) to accommodate vehicles using all entry/exit options i.e., hoist/lift/ramp. For example, where 60 parking spaces are provided, three spaces should be designated for standard cars used by drivers/passengers with disabilities and one space designated for

larger multipurpose vehicle use. Premises with high usage by persons with disability may require a larger than average number of designated spaces. The surface of the bay and adjacent accessibility zone should be firm, durable and slip-resistant. Examples of inappropriate materials are loose sand, cobbles or gravel. The colouring used for accessible parking bays should be white markings on a slip resistant blue surface. The adjacent accessibility zone should be cross-hatched in yellow. The colour and proportion details are visualised in the below image:
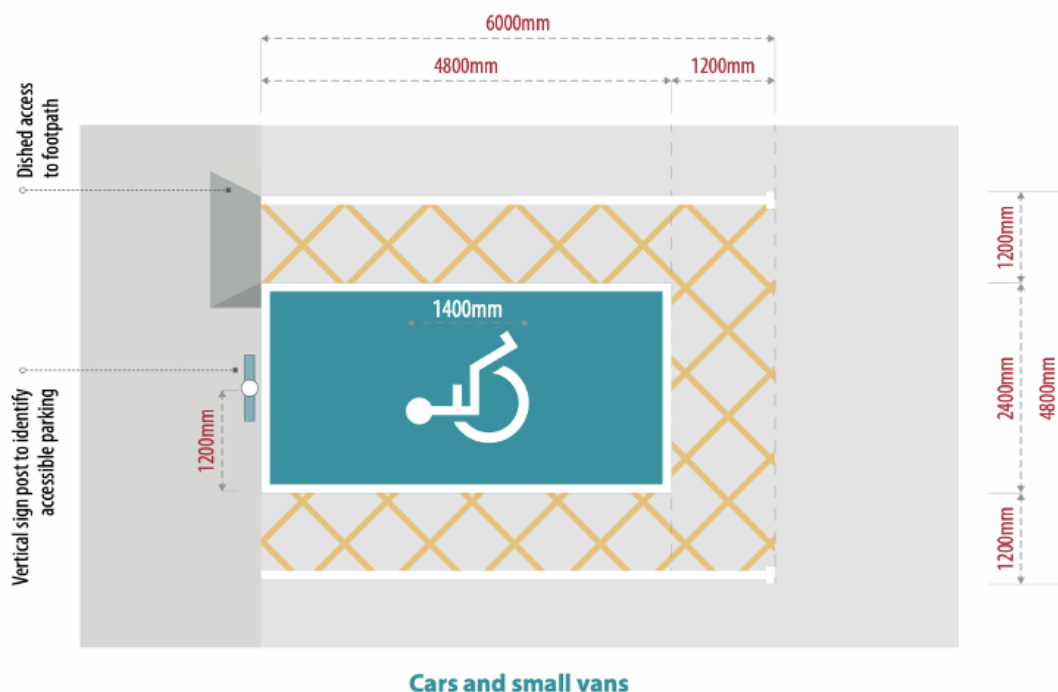
Figure 10 Parking best practices

In addition to the above provision, spaces should be provided for employees who require accessible parking. Separate spaces should accommodate women who are pregnant and parents with young children. All spaces are to be clearly designated with the appropriate signage.

5.2.1 AI Process

The steps required to train our classifier at a high level can be broken down into the following steps:

1. Gathering of data;

2. Cleansing data;

3. Training the classifier with the data;

4. Applying training labels to the data to highlight the specified objects of interest; and,

5. Iterating this entire process to improve the classifiers performance.

Figure 11 AI training image

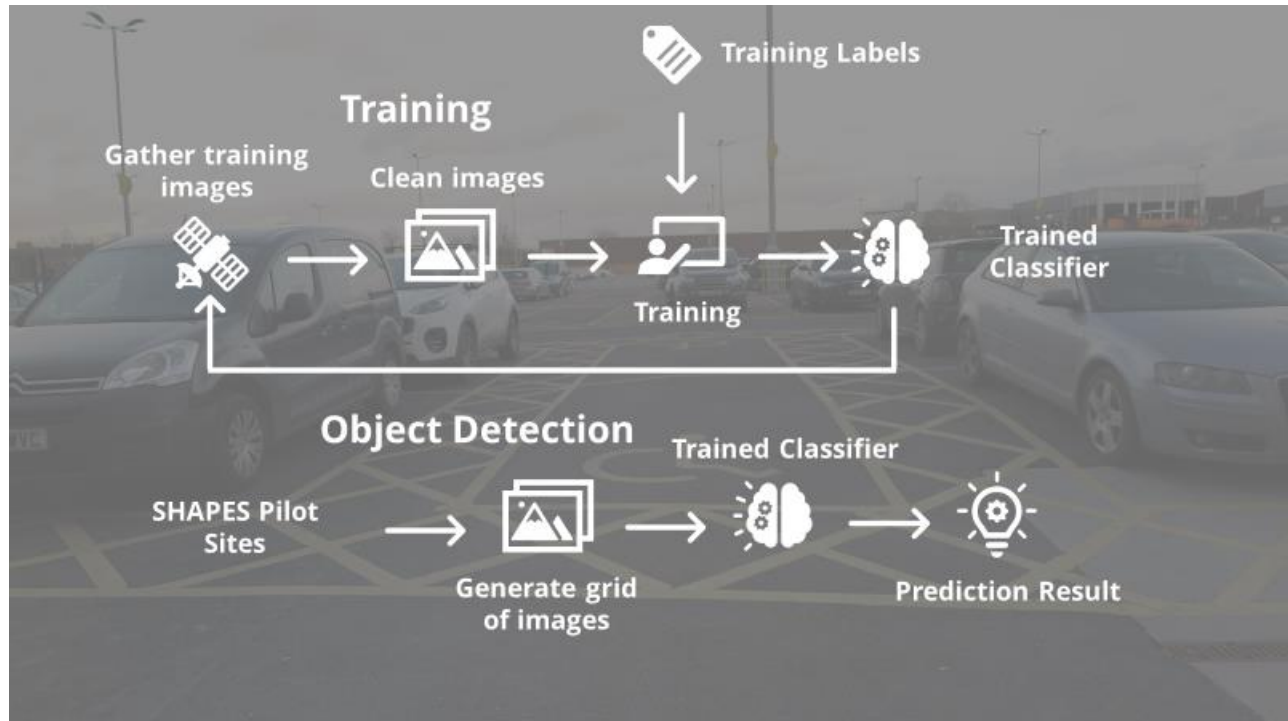Once the classifier has reached an adequate standard of accuracy, we can then begin feeding it real world data to analyse and interpret in order to provide us with our desired results.

5.2.2 Object Detection vs Object Recognition

Object detection is the process of finding instances of objects in images. In the case of deep learning, object detection is a subset of object recognition, where the object is not only identified but also located in an image. For the purpose of this classifier, we need to be able to not only recognise the wheelchair in the space but also identify where in the image it is located. From this we can assert not only if an image contains accessible parking but how many there are and where they are located. From the meta data provided about the specific positive image we can then locate and add the newly found accessible parking information to our database.

5.2.3 Data Gathering

Vast amounts of data is key to creating a robust and highly accurate classifier. The quality of the data the classifier is trained on is directly related to how well the classifier

can perform. The closer the training images are to the real world examples the classifier will be expected to interpret, the more likely a successful classification will take place. To train our classifier we have used satellite images of accessible parking spots from around Ireland, from built up areas to rural locations, to ensure we could appropriately capture as many edge case examples of accessible parking as possible.

5.2.4 Data Cleansing & Applying Labels

Before we can add an image to our classifiers training pool, we are required to perform a data cleansing check to ensure a number of criteria are met. The image in question is required to be of a high enough resolution, has at least one example of the key object we hope to detect (i.e. accessible parking) and be orientated sufficiently. If the image does not meet these standards and cannot be edited to correct them it must then be discarded. This is in order to protect the integrity of the classifiers training data. Poor examples lead to poor performance. Once a piece of data has passed through cleansing it must then have labels applied to it. These labels help the classifier understand what objects it is being trained to detect. In the case of this project, we are labelling all accessible parking found in the training images.

5.2.5 Training

Training a classifier is a largely iterative approach where one switches between data gathering, cleansing, labelling, testing and repeating. Ideally each iteration shows a marked improvement within performance from the previous, but in cases where there has been a loss of accuracy one most re-assess the previous batch of training data to ensure they haven't added in a poor-quality example. If you have lowered the accuracy of your classifier you must check to see if you have appropriately trained it with enough basic images of the most easily identifiable examples first before adding in difficult to find edge cases. Training a model too early, on difficult to interpret images, will increase the chances of it not just failing to find your desired object but also will increase the probability of you having a false positive.

5.3 User Interface

The User Interface updates were informed by feedback given during the Philadelphia feedback session as discussed in section 3.

The updates included:

- The removal of the upper nav bar and lower tabs section to increase the maps digital real-estate.
- The creation of floating buttons for the filter categories to keep category functionality without the need for the removed tab section.
- The inclusion of a floating search bar to encourage use from users.

- The presentation of accessible assets in "word cloud" format (see section 4.2.2)
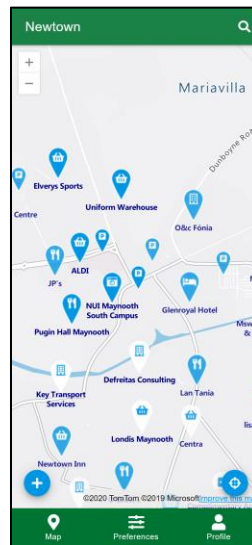

Figure 12 Original Map User Interface
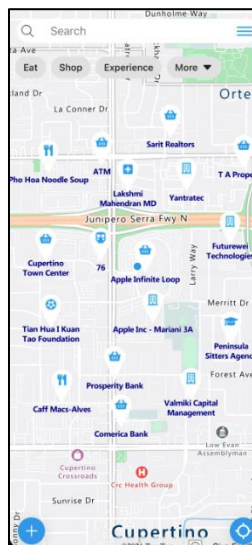

Figure 13 New Map User Interface

5.4 Information Gathering

This section will itemise the new categories and assets added to the AELTD platform based on the feedback and research gathered as discussed in the above sections.

5.4.1 COVID-19

It was decided to include COVID-19 relevant information for inclusion as part of the Access Earth platform. With the risks associated to individuals who are immunocompromised or in other at-risk categories, it was deemed prudent for this data to be displayed alongside the other important accessibility information SHAPES users would require in order to make informed decisions relating to accessing physical spaces.

These items include:

- Are Personal Protective Equipment (PPE) offered to customers?
- Are Personal Protective Equipment (PPE) used by staff?
- Are frequently used surfaces cleaned regularly?
- Are social distancing measures in place?
- Are the number of people who can enter this building at one time limited?
- Is a home delivery service available?
- Is a collection service available?
- Are priority opening hours for at risk people available?

5.4.2 Physical Mobility

Physical access criteria were something that was present in the first stages of the AELTD platform however the conduction of the user interviews and SHAPES partner feedback sessions it was decided that the list would be further augmented to the finalised list below. In keeping with the redesign detailed above all criteria is either

- Step free entrance
- Wide enough doors for a mobility device
- Lifts available
- Ground floor only
- Restrooms available
- Wheelchair accessible restrooms
- Wheelchair hotel rooms
- Roll-in showers
- Handrails
- Food Allergy Information
- Accessible Parking
- Public Seating

5.4.3 Sensory Information

The app redesign included an entirely new section for the inclusion of sensory information into the platform. Philadelphia case study helped inform the following listed items greatly for the platform.

- Service animal friendly
- Large print menus
- Braille Menus
- Digital Menus
- Hearing induction loop
- Sign language interpreter
- Quiet hours available
- Spacing between tables
- Quiet Areas
- High Luminated Area
- Low Luminated Area

5.5 Further User Experience Changes

In additional to the above criteria and UI changes from the original platform prior to SHAPES, AELTD has improved certain user elements to increase overall accessibility and user enjoyment of the application.

These include:

- Redesign map screen to increase size (see figure 13 above)
- Dark mode to reduce screen glare for light sensitive users.
- Screen reader friendliness (see subsection below for further details)
- Bubble layout design for assets presentation (see figure 9 above)

5.5.1 Screen Reader Improvements

A screen reader is an assistant technology that communicates to a user both text and images as either an audio or braille output and is mostly used by individuals with visual impairments (Smaradottir, Håland, & Martinez, 2018).

To make the AELTD platform better able to work with most commercially available screen reader software the team had to wrap most text and visual components in appropriate "tags" and "divs" that the software uses to identify the type of information it is relaying to its user. (E.G. if the information is text or an image).

This tagging system has it's origins in web development, and since AELTD platform is built atop the Ionic Framework, AELTD were able to implement this without the inclusion of many hours of additional development work. Feedback will be continually sought by

screen reader users to improve this experience even further than its current improved state.

6 Pilot Site Deployment

This section will discuss the preparations and plans for pilot site testing. It will focus on which elements of the platform are to be studied and how success will be measured. This section will also focus on the key assumptions and hopeful outputs from the pilot sites.

The key challenges faced to a successful deployment and engagement faced due to COVID 19 travel restrictions and constraints will be addressed while highlighting the mitigation strategies and plans to overcome them.

This section will end with an overview of the AELTD Workshop toolkit and requirements necessary for any SHAPES partner to run a successful mapping campaign using the AELTD system.

6.1 Pilot Theme PT7-002

The AELTD platform is due to be deployed in 2022, as part of the Pilot theme PT7-002 for the use case entitled; "Foster older people's (with physical disabilities) independent living by identifying accessible locations and routes in other locations (domestic and abroad)". This pilot site will experience the full feature set deployment of the platform, including AI Parking analysis, crowdsourcing application, interactive plugin and mapping event deployment strategy.

The success of this pilot site deployment will be measured by focusing on two specific areas. This first area, as we will discuss in section 6.1.1, will focus on the users' opinions and feedback on the AELTD platform itself, measuring such aspects as ease of use, value in data provided and overall performance of the platform during its operation.

The second area, detailed in section 6.1.2, will focus on the level of community and user engagement during the initial deployment time of the AELTD platform. Success will be measured in how many local stakeholders within the surrounding pilot site community are able to be engaged to participate, how many locations can be added natively to the platform as well as how many additional users can be onboarded.

These two aspects, both technology performance and deployment strategy are essential elements for a successful pilot site campaign.

6.1.1 Technology Performance

As there are multiple technologies being used, see section 2.2 for full overview, to make the AELTD platform, we must measure each of their performances separately and then further assess their effectiveness once combined.

The AELTD crowdsourcing applications performance will be measured in both response time and load handling during peak times, as well as through user led feedback sessions on its ease of use and UI design.

The AI parking analysis will be measured in its ability to successfully input data into the platforms system from obtained aerial data.

The interactive plugin system will be assed based on load times and user led feedback based on its ease of use, design and onboarding experience.

Finally, how well these technologies come together to add value to the pilot site will be measured based on how quickly data points can be added and accessed into the system and by how often users interact with the platform during their regular daily activities.

6.1.2 Deployment Strategy

Community involvement is crucial for the longevity and overall impact the AELTD platform can have on a target area. Therefore, as outlined in the section 2.3, it is paramount to engage with local residents, businesses, community groups and municipalities ahead of and during a platform deployment.

Using the lessons learned from the Philadelphia case study in section 3.2.1, a mapping event will be held to promote the deployment of the AELTD platform for the pilot site location.

The success of this event as part of the deployment strategy will be determined by a number of factors. The first of which will be based on the number of local stakeholders involved (community groups, local businesses, residents, etc), followed by social media and traditional media outreach metrics (local radio, newspaper, social media engagements, etc.) and finally by the number of locations added to the AELTD platform by local stakeholder during the life cycle of the campaign itself.

The processes involved for engaging and informing local stakeholders is discussed briefly in the context of the Philadelphia case study in section 3.2.1 and goes into more practical level detail in section 6.2 Workshop Toolkit.

The Workshop Toolkit, as outlined in the below section, will be used as part of the deployment strategy for participating pilot locations. This will be done to ensure the successful deployment and integration of the platform within the community area but also as a means to further verify and validate the strategies and processes discussed in section 6.2.

6.2 Workshop Toolkit

This section goes into the practical steps and suggestions for running a successful mapping event as part of a deployment strategy for the AELTD platform. It has been

divided into three key areas, Stakeholders, Workshop Content and Campaign Engagement. These areas cover the full lifecycle of a deployment, from pre-planning to post-campaign analysis.

This section is the combined results of the previous user testing, interviews, and respondent engagement.

6.2.1 Stakeholders

Before a deployment can begin, it is critical that local stakeholders are engaged. These stakeholders' participation is paramount for the surrounding community to successfully adopt the platform. Though older individuals are the specific user groups who are the primary focus for the platforms engagement and are the direct and initial use cases of the AELTD platform, the integration and meshing of this demographic within their local community and societal structure is pivotal to help create a lasting sense of involvement and belonging. By highlighting how this platform can benefit everyone within a deployment area through stakeholder interaction we will be creating the AELTD platform as a neutral ground for these different groups to come together for their mutual benefit and communal aid.

But who are these stakeholders? How do we identify them, and, how do we get them to participate within the deployment process?

Stakeholders can generally fit into the following list;

- Local government/municipality bodies who are responsible for the betterment and welfare of their specific area.
- Support organisations (Healthcare workers and experts).
- Large Corporations/Employers based in the area looking for corporate social responsibility activities.
- Local businesses looking to support their community and attract more customers
- Local and National level Community Groups such as tidy towns or access focused volunteer bodies.

If the deployment of the AELTD Platform is being conducted as the result of a municipality purchase order, they will have a network in place to engage stakeholders with. If the deployment is happening independently of a local government body deployment personnel can still reach out to them directly for their involvement and support. Usually access officers, diversity and inclusivity officers or similar roles will be the most likely person to reach out to connect with.

Support organisations, particularly ones in the field of healthcare, can be accessed by direct communication, especially if they have offices or headquarters in the local area the platform is being deployed. If difficulties are experienced while engaging with these organisations at the beginning, it is recommended to wait until more direct involvement from accessible volunteer groups or local residence has been established. These

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individuals can have personal networks and connections or overlapping involvement with these aforementioned organisation that can be utilised to engage with decision makers.

To engage large scale employers, search recent media releases on their website for community events or look for diversity and inclusivity officers within the organisation to reach out to. If a suitable role cannot found within the company to engage with reaching out to their Human Resources department can be of benefit. Similarly, to support organisations, if difficulty engaging with these larger businesses is experienced, wait until more local support has been established as some of these members could have personal connections with the company to engage through.

Local businesses and community groups will be more time consuming in tracking down as they will all need to be contacted with independently. If engagement with any other local stakeholders' groups or residence has been established it would be advised to see if they are able to help track down and engage these elements. Local access groups and community groups, especially active ones, can be excellent networks to help onboard and engage local businesses. They can help also identify possible "access champions" within the local area. Access champions are people or businesses that can act as exemplary illustration of good practices for accessibility within the area. These champions are important to offer publicity and promotion during a mapping campaign.

A good rule of thumb to follow when attempting to identify suitable stakeholders to engage with is by asking the following questions.

- Does this group have a vested interest in this specific area?
- Does this group care about accessibility, older person care or health related issues?
- Does this group wish to benefit from positive local/national media attention?

If the group being vetted answers yes to one or more of these questions, then they are more than likely a suitable stakeholder worth reaching out to.

Another guiding principle to follow if experiencing difficulties in establishing appropriate connections to a desired stakeholder is to ask these questions:

- Do current networks have access to this person/group?
- Is it possible to access an adjacent group more easily and then get introductions from them?
- Is it possible for established social media channels to engage with the targets social media channels as a jumping off point?

When reaching out to potential stakeholders for their involvement it is important to have a consistent message. A well defined "ask" needs to be clear and precise.

The following information must be established when reaching out to potential stakeholders;

- Who you are? (Deployment group for the SHAPES eco system or AELTD Platform)
- Why you are contacting them? (To offer their participation in a local accessibility focused community event.)
- What is it they would have to do? (The level of the participation is different for each stakeholder but one ask is required for each potential member. Attendance at a workshop for the campaign.)

Multiple workshop events may need to be scheduled to ensure the largest number of attendees can be accommodated. Plan for a minimum of two events and adjust according to budget and needs.

6.2.2 Workshop Content

The goals for the workshops should be to introduce the stakeholders and attendees to the AELTD platform and highlight to them the benefits it can have for their local community, businesses and older population. It should explain to them what a mapping event is and how people can participate.

The workshop should be an interactive presentation asking participants which areas in their community would they like to see focused on for the mapping event and which accessible champions would they like to highlight and promote as best examples within their community.

The workshop should let attendees know that the AELTD platform can still take in inputs from participants beyond the mapping event campaign itself underlining the fact that the more the platform is engaged with the further impact and value it can bring to their area.

The interactive plugin should be demonstrated, and all materials shared with participants who attend.

Stakeholders form private companies/businesses who wish to participate will be encouraged to introduce themselves to the gathered attendees. If these stakeholders wish to offer prizes for most engaged participants during the mapping event this would be an ideal time for this to be mentioned.

All participating stakeholders should be encouraged to participate in sharing their own ideas on the best and most novel ways to promote the mapping event to their local communities beyond the usual social media campaigns and traditional media advertisements. Any ideas that garner excitement and ownership from the present stakeholders should be supported and praised.

By the end of the workshop the following should be accomplished;

- Dates and times for mapping event agreed by stakeholders.

- Dates and times for the commencement of mapping event promotional campaign.
- Appropriate event hashtags decided upon by stakeholders for social media promotion. (e.g. AccessCork)
- Email list for attendees created to help maintain communication with all attendees.
- Social media accounts for engaged businesses and participating groups gathered to ensure appropriate digital engagement.

It is recommended that the workshops be performed digitally if possible and for sign language interpreters to be present. If a physical workshop is required and can be held locally, this ensures it can also be presented digitally to allow for remote engagement.

6.2.3 Campaign Engagement

For a mapping event to maintain its effectiveness both during and after the campaign one must ensure a media presence is maintained.

The public should be encouraged to share selfies and videos of their participation during the campaign week using the event hashtags which will then be further promoted through social media channels to encourage further engagement and interaction.

Daily tallies of the number of locations being rated or accessible parking spots being added to the AELTD platform from the event should be communicated at each days end for the duration of the event with a final tally being announced upon completion.

If prizes have been secured by stakeholders these items should be promoted alongside the tally posts to further encourage friendly competition amongst participants.

By the close of the campaign you should have the following completed:

Outcomes:

- The successful running of a mapping event within designated spots.

- The continued update and promotion for the campaign long mapping event highlighting participants social media engagement.

- The sharing and promotion of total accessible information gathered via the AELTD platform.

6.2.3.1 Post-event analysis.

Upon completion of the mapping event a QA report document outlining the key metrics for the event will be provided to all necessary stakeholders. This will include pictures from the event itself where appropriate and include total number of accounts registered on the run up to the event, total number of locations added within the deployment areas during the campaign timeline and further key numbers required to give the overall impact for the event itself.

These metrics include but are not limited to:

1. Campaign promotional engagement.

How many interactions promotional materials posted on social media accounts by AELTD and stakeholders social media accounts have in the run up to said event.

2. Campaign event participation numbers.

How many people attended in person to live events/workshops or logged into participate within digital events/workshops.

3. Number of locations rated during campaign.

How many locations had accessibility information added via the AELTD platform for the targeted city/town throughout the campaign/event.

4. Total number of engagements.

How many interactions all campaign updates, posts, promotional materials achieved for AELTD and stakeholder's social media accounts.

7 Ethical requirements

The AELTD platform is, in essence, a data-based platform and is defined by how its key data points are shared, displayed, verified and, most importantly, recorded.

When the data gathering part of a platform is a key element to its design and implementation, privacy and data security should be a key focus. AELTD only collect user data freely offered by its users that also serves as key data for the functionality of the core features for the platform.

Specifically, user data that is stored within the system include information for logging in, reviews written about locations, and location data only for the purposes of displaying to the user where they are in relation to other positions within their current environment. No tracking data is gathered beyond these core features. In addition to this, users who answer the questionnaires about locations have their answers anonymised within the system, only written reviews can be associated to user accounts. These questionnaire ratings are aggregated, and their total number of answers are displayed for users to see the popularity of a location, but they will not be able to associate any questionnaire answer to an individual's account beyond a written review. Users will be able to request all data that has been stored directly associated with their account and even request for said data to be deleted.

The focus of this compliance check is on the ethical requirements defined in D8.4 and having impact on the SHAPES solution (technology and related digital services, user processes and support, governance-, business- and ecosystem models). In the left column there are ethical issues identified and discussed in D8.4.(corresponding D8.4 subsection in parenthesis). For each deliverable, report on how these requirements have been taken into account. If the requirement is not relevant for the deliverable, enter N / A in the right-hand column.

Ethical issue (corresponding number of D8.4 subsection in parenthesis)	How we have taken this into account in this deliverable (if relevant)
Fundamental Rights (3.1)	Research and co-creation actions fulfilled the set requirements in D8.4.
Biomedical Ethics and Ethics of Care (3.2)	N/A

CRPD and supported decision-making (3.3)	Research, co-creation and networking actions fulfilled the set requirements in D8.4.
Capabilities approach (3.4)	N/A
Sustainable Development and CSR (4.1)	Research, co-creation and networking actions fulfilled the set requirements in D8.4.
Customer logic approach (4.2)	Research, co-creation and networking actions fulfilled the set requirements in D8.4.
Artificial intelligence (4.3)	Research, co-creation and networking actions fulfilled the set requirements in D8.4.
Digital transformation (4.4)	Research, co-creation and foresight actions fulfilled the set requirements in D8.4.
Privacy and data protection (5)	Research, co-creation and networking actions fulfilled the set requirements in D8.4.
Cyber security and resilience (6)	N/A
Digital inclusion (7.1)	Research, co-creation and networking actions fulfilled the set requirements in D8.4.
The moral division of labor (7.2)	N/A
Care givers and welfare technology (7.3)	Research, co-creation and networking actions fulfilled the set requirements in D8.4.
Movement of caregivers across Europe (7.4)	N/A

8 Future Plans

Throughout engagement with additional partner research the need for the direct interaction or involvement with governing bodies is a crucial next step for the evolution of the platform. AELTD will attempt to work alongside WP3 to establish networks and strategies to involve the data contained within the AELTD platform with public government decision makers.

This data being gathered, though crucial for individual users to make informed decisions on how and where they can navigate the physical environment, would also be immensely impactful in the hands of decision makers and policy advocates.

Future improvements to the AELTD platform will include the addition of further criteria to be gathered by the system. Including nature walks accessibility information. Blue and green ways data are crucial for the encouragement of engagement outside of urban landscapes and would be more beneficial for rural platform users.

The ability for users to include image data of locations they have visited or for businesses to self-promote their accessibility to users of the platform would add further value to the platform.

Integration with existing and emerging technologies that can enhance the user's engagement with both the data gathered within the platform and their surrounding area is necessary for the future proofing of the system. To this end plans to include voice assistant interaction and route planning are presently being explored as well as the possibility for the inclusion of a family and/or healthcare check in system for patient safety services.

By the time pilot site deployment finishes in October of 2022 all SHAPES participating member languages will be included within the system. For universal access, a comprehensive language solution would be ideal, to ensure proper localisation in all required languages.

9 Conclusion

AELTD has gone through great efforts to understand the issues and problems faced by current and future AELTD platform users. This document has outlined the various sources which have been drawn from to create an accurate and fully realised image of who these users are and what information matters to them most. These sources include interviews conducted before and as part of this task's life cycle, extracts from interviews conducted as part of other SHAPES deliverables, as well as personas and use case examples developed as outputs from other SHAPES tasks.

The data gathered and analysed as part of this document has been demonstrated to inform both the approaches used to verify how the AELTD platform is built and will be developed in the future, but also as to how best to approach the deployment of the platform within any given community, a matter which is equally as important.

The efforts mentioned here are required to be truly user led and user focused when it comes to establishing a platform that can deliver real, meaningful, and impactful value to both the intended users as well as their surrounding community.

This deliverable has succeeded in its goal of creating a fully deployable tool kit to map a built environment using the AELTD platform and will be further tested on future dates using participating SHAPES pilot sites.

The ability to have accessibility information available to individuals about their surrounding built environment in an easy to interact with format, will be instrumental in encouraging home prescribed care and continued independence for advanced aged individuals. The AELTD platform will be able to provide this information to the individual level but also has the capacity to inform local governance decision making and compliance verification processes and help build smarter, more inclusive societies for everyone. Looking to the future, without conscious consideration towards accessibility needs, we will fall into the trap of designing environments we may all eventually age out of and exclude others from.

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