



D1.5

Data Management Plan mid-term version

PoDIUM

PDI connectivity and cooperation enablers building trust and sustainability for CCAM

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List of abbreviations and acronyms

Abbreviation	Meaning
API	Application Programming Interface
CAM	Cooperative Awareness Message
CCAM	Cooperative, Connected and Automated Mobility
CC BY	Creative Commons Attribution International Public License
CC 0	Creative Common Public Domain Dedication
C-ITS	Cooperative Intelligent Transportation System
CPM	Certified Public Manager
DENM	Decentralized Environmental Notification Messages
DMP	Data Management Plan
DMPO	Data Management and Protection Officer
DT	Digital Twin
EC	European Commission
ETSI	European Telecommunications Standards Institute
EU	European Union
FAIR	Findable, Accessible, Interoperable and Re-useable
GDPR	General Data Protection Regulation
ICCS	Institute of Communication and Computer Systems
IPR	Intellectual Property Rights
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
KPI	Key Performance Indicator
LiDAR	Light Detection and Ranging
MEC	Multi-access Edge Computing
PCAP	Packet Capture
PU	Public
RSU	Roadside Unit
UC	Use Case
VAM	Virtual Antenna Mapping
VRUs	Vulnerable Road Users
WP	Work Package

XML	Extensible Markup Language
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Executive Summary

This document is the Data Management Plan (DMP) for the project PoDIUM – PDI connectivity and cooperation enablers building trust and sustainability for Connected, Cooperative and Automated Mobility (CCAM). This Data Management Plan presents guidelines including the description of the data, procedures for data management and data management tools for accessing and using the PoDIUM data for research purposes.

PoDIUM will generate and handle different types of data in the following categories: technical data, evaluation data, user acceptance data, internal administrative data, and data on project outcomes and studies. These data types differ in their purpose and how they are handled. Generally, stored technical data which is used for development and validation, evaluation data and data on project outcomes and studies will be made available as open as possible, without conflicting with the law or commercial interests and intellectual property rights (IPRs) of partners. User acceptance data will be made available as far as possible in accordance with the General Data Protection Regulation (GDPR). Internal administrative data is internal working material and will not be made available beyond the consortium. The principles of making data findable, accessible, interoperable and re-useable (FAIR) will be applied in the project. There are differences among the data categories in terms of how FAIR principles are applied, which are described in the document.

This document collects and describes the result of Work Package (WP) 1, task T1.3 – Data Management Plan, and fulfils the requirements for deliverable 1.5 – Data Management Plan. It is primarily intended to serve as a comprehensive internal guideline and reference for all PoDIUM beneficiaries. It is formulated with insights from the Grant Agreement, and together with the Grant Agreement, serves as the foundational reference for all data management activities within PoDIUM. All project partners are responsible for collecting, managing and sharing data according to the guidelines and procedures detailed in the DMP.

The structure of this deliverable is as follows:

- Chapter 1 – Introduction – introduces the project and the purpose of the deliverable.
- Chapter 2 – Data summary – provides a description of the types of data to be generated by the project and specifies information about the data types.
- Chapter 3 – FAIR data – describes how data will be made findable, accessible, interoperable and re-useable.
- Chapter 4 – Data protection and ethical aspects – details the methodology to be followed to reach compliance with data protection regulation and consideration of ethical aspects.
- Chapter 5 – Data security – describes the approach towards guaranteeing data security.
- Chapter 6 – Other research outputs – describes management of other research outputs.
- Chapter 7 – Allocation of resources – describes how allocation of required resources for data management is implemented.
- Chapter 8 – Other issues – describes other issues related to data management.
- Chapter 9 – Conclusions – concludes the deliverable.

This deliverable is the second version of the Data Management Plan, which presents the Data Management Plan for PoDIUM with the state of information at M18 of the project. It will be updated in M36 as D1.6.

1. Introduction

1.1. Project intro

PoDIUM aims to support advanced Use Cases (UCs) of connected and cooperative automated mobility in real traffic conditions. Building on the proposed urban and highway Ucs in the facilities of 3 well-equipped Living Labs in Germany, Italy and Spain, PoDIUM will address a comprehensive range of requirements for availability and performance of connectivity as well as the different cooperation enablers per UC. The proposed UCs aim to advance a set of key technologies within both the physical and digital components of mobility infrastructure. In particular, the following non-exhaustive list of contributions will be pursued:

- A multi-connectivity approach to ensure reliability, availability and redundancy of the Physical and Digital Infrastructure (PDI) system.
- Advanced data fusion and integration of Multi-access Edge Computing (MEC) to the proposed hybrid data management environment to enable enhanced environment perception models towards digital twins.
- New Cooperative Intelligent Transport Systems (C-ITS) messages for enabling the specific advanced CCAM UCs.
- Ensure software integrity, trust and truthfulness of CCAM data, their exchange and their processing.
- Demonstration of urban and highway UCs in a diverse set of configurations with the integration of Vulnerable Road Users (VRUs).

1.2. Purpose of the deliverable

This Data Management Plan provides a complete set of guidelines including the description of the data and data management tools for accessing and using the PoDIUM data for research purposes.

This DMP is elaborated as part of WP1 to define procedures on how to handle personal data to guarantee citizens' fundamental rights and avoid misuse of the project results. It specifies how the data will be securely stored and whether it will be destroyed at the end of the project or archived for further use by the research community. In the latter case, the DMP provides recommendations for future maintenance and access to the data by consortium partners and external parties. The DMP also ensures that the data is made Findable, Accessible, Interoperable and Re-useable (FAIR). Data privacy and security issues are also addressed in the DMP, where related requirements and applicable standards will be specified. The principle is to be as open as possible and to provide data except those, which are conflicting with the law or commercial interests and IPRs of partners. The DMP complies with the European Union (EU) and international regulations for the management and use of data, and aligns with GDPR.

This deliverable represents the second version of the Data Management Plan, crafted to be as comprehensive as possible based on our current understanding. Significant aspects of the data collection procedures and systems are currently being developed under Task 4.1: Planning and deployment of PoDIUM platform architecture and data collection tools. Additionally, Task 5.1: Evaluation Design has commenced, further contributing to the refinement of our data management strategies.

1.3. Intended audience

The dissemination level of D1.5 is 'public' (PU), thus the deliverable is available not only to members of the consortium and the European Commission (EC) Services but also to those outside the project. This document is primarily intended to serve as an internal guideline and reference for all PoDIUM beneficiaries, especially the governance bodies such as the General Assembly, the Technical Management Team, and the External Advisory Board.

2. Data summary

This section provides a description of the types of data to be generated by the project.

It is not foreseen that PoDIUM will re-use any existing data. The data which will be used in PoDIUM will be fully generated in the project, although the developments are based on the work of previous projects as well, such as in virtual tests in C-ROADS, where C-ITS messages have been exchanged as packet capture (PCAP) files and analysed by different partners in different countries. If in the future any existing data is re-used in PoDIUM, this will be described in the updated Data Management Plans.

PoDIUM will generate and handle different types of data which can be organised into the following main categories:

- **Technical data:** related to the technical development and operation of the PoDIUM reference architecture and the deployed UCs.
- **Evaluation data:** related to testing and evaluation processes. This includes measurements of the performance indicators as well as data required to validate the results presented in the outcomes and scientific publications.
- **User acceptance data:** collected in user acceptance questionnaires among UC demonstration participants.
- **Internal administrative data:** data generated/shared internally for administrative and management purposes.
- **Data on project outcomes and studies:** data generated from managerial, technical and scientific activities for reporting project achievements.

2.1. Technical data

Technical data includes C-ITS data, sensor data, processed data, communication network data, or other data necessary for development or operation. **Error! Reference source not found.** provides a description and examples of data for each data category. The table also shows that much of this data is put into C-ITS messages and exchanged between the vehicles and the infrastructure.

The systems deployed in this project, including sensors and components within automated vehicles, generate a significant volume of data. However, only a fraction of this data is directly utilized for development and validation, making it relevant to the Data Management Plan. Specifically, data not involved in research and development activities, such as vehicle data unrelated to positioning or environment representation, is excluded from detailed coverage. Tasks such as 4.1 "Data Collection" and 5.1 "Data Evaluation," initiated in month 13 of the project, will shape the Data Management Plan

by customizing collection strategies, integration plans, and evaluation methodologies to align with project objectives according to the Grant Agreement.

A significant portion of the data exchanged within the project serves purely for operational purposes. Storing such data is not essential for the project's objectives and would result to an unnecessarily large volume of data to be stored and managed (e.g., each vehicle sends 10 cooperative awareness messages (CAMs) per second, resulting in large amounts of data). Consequently, this data will also not be made available. However, to ensure transparency and support the verification of our developments, the data critical for these purposes will be made available and accessible.

The listing of processed data relies heavily on decisions made during Task 4.1, known as "Data Collection." This task plays a crucial role in determining the relevance of various data types and involves defining integration and pre-testing plans at PoDIUM Living Labs (LLs), considering the specificities and needs of each Use Case (UC). Task 4.1 recognizes the importance of collecting data pertinent to PDI technologies' development and assessment. However, it also identifies data not essential for project goals, ensuring that only relevant data is included in the Data Management Plan. Consequently, the outcome of Task 4.1 significantly influences the composition and scope of processed data within the project.

Technical data overview Table 1

Technical data subcategories	Description of data	Examples	Data provision format
C-ITS messages	In the UCs, an collection of C-ITS messages including CAM, DENM, IVIM, VAM, CPM and MCM, will facilitate the exchange of information between infrastructures and road users, encompassing both vehicles and VRUs	UC 2: Infrastructure informs connected vehicles about the presence of an emergency vehicle through decentralized environmental notification messages (DENMs)	The standards for C-ITS messages and protocols are outlined in deliverable 2.3. The data from messages is provided in various formats, including PCAP for standardized messages and JSON or XML for PoDIUM-extended messages, ensuring interoperability within the project's infrastructure.
Sensor data	Data collected by sensors (infrastructure and vehicle sensors).	UC 4: Object detection by roadside unit (RSU) cameras and light detection and ranging (LiDARs)	In the systems used in PoDIUM, a lot of sensor data is generated. This data is further used and exchanged in the project in processed form. C-ITS messages are (often) used for this purpose: Position data is exchanged in the form of CAM, VRU awareness messages (VAM) or DENM, and environmental information via Collective Perception Messages (CPM). Therefore, this data is also provided in the form of C-ITS messages.
Processed data	Data resulting from the fusion and processing of sensor and other input data ¹	UC 5: Information of current events from the traffic control centre	Task 4.1 will shape future processed data by defining strategies tailored to the project's needs. It ensures only relevant data is included in the plan, optimizing resource use and focusing on key goals.

¹Please note: Only data that is utilized in the final output is being considered.

Data from the communication network	Meta data describing the communication quality between the vehicles with the MEC using different communication technologies.	UC 1: reliable data transmission for cooperative corridor management	Data, indicating endpoint transmission and reception times along with packet sizes, is furnished in CSV format. Summary statistics for packet loss fraction will also be available in CSV format, alongside additional data on round-trip delays. However, it's important to note that the evaluation task has just begun, and it will take time to obtain data from it.
Risk level indication	Risk level data is still under definition	UC 5: Digital twin risk level evaluation	The absence of risk level indication within the Digital Twin (DT) modelling the tunnel is notable, especially as we await the evaluation task for further insights.
Quality indicators for truthfulness	An indicator will be defined based on the redundancy of the information or other data fusion techniques used.	UC4: The presence and position of a VRU or vehicle is assessed by a high quality indicator as multiple sources of this information are available (RSU Camera sensor + CAM messages + vehicle sensors).	Truthfulness data will be referring to the information in the DT or will be provided via a parallel structure to DT.

2.2. Overview data categories

The PODIUM website should be a one-stop shop for project data. A detailed inventory with links will guide users to the data they need. Partners will upload data (technical, evaluation, C-ITS messages) or link to Zenodo repositories. Information on extensions and standards will be on the website with Zenodo links if applicable. User data access will be determined later but will follow FAIR principles.

Overview of the data categories Tabel 2

Data category (incl. brief description)	Subcategory	Provision via (according to the current version of the DMP)
Technical data: related to the technical development and operation of the PoDIUM reference architecture and the deployed UCs.	C-ITS messages	Messages will be accessible either directly through participants' repositories for sharing research data or through Zenodo.
	Information on extension of C-ITS messages	Information will be provided, if possible, via the website and via open source repositories that follow the FAIR principle, e.g., Zenodo.
Evaluation data includes performance measurements and validation data for outcomes and publications.	Evaluation data	Accessibility for evaluation data will also be provided, through either Zenodo (via links) or directly through participants' repositories.
	C-ITS messages	C-ITS messages for the various potential purposes will be made accessible either directly through participants' repositories for sharing data or through portals such as Zenodo.
	Information on used standards and profiles on PoDIUM extensions of C-ITS messages	Information will be provided via the PoDIUM website and via Zenodo.
User acceptance data: collected in user acceptance questionnaires among UC demonstration participants.		The current DMP lacks specific details on the method of information provision. It only mentions that the data gathered from user questionnaire responses during pilots will be made findable, accessible, interoperable, and reusable, with the

		stipulation that any personal user information will be removed before publication.
Internal administrative data: data generated/shared internally for administrative and management purposes.	n.a.	n.a.
Data on project outcomes and studies: data generated from managerial, technical and scientific activities for reporting project achievements	Research publications	The data will be stored in reputable repositories listed in OpenAIRE (Open Access Infrastructure for Research in Europe), such as Zenodo, or in institutional repositories belonging to project partners. Some technical/scientific papers might be published via institutional repositories due to copyright concerns, all of which adhere to the FAIR principles.

2.3. Evaluation data

This category contains all data from the project's evaluation tasks. Evaluation data contains the results of the evaluation of the pilots as well as the UCs and new services resulting from the project. This data generated from the internal tests performed through the project UCs evaluation and validation will be made available.

Data on the assessment of performance metrics and especially key performance indicators (KPIs) measures are of particular interest for the whole community - and are at the same time a key value for the implemented solutions in order to become market ready.

The exact details of the generated evaluation data, such as its type and format, will be specified once the comprehensive definition of the evaluation procedures and Key Performance Indicators (KPIs) is finalized. This process involves careful consideration and collaboration among project partners to ensure that the selected evaluation metrics align closely with project objectives and accurately measure performance. Additionally, the specific data required to validate project results will be defined alongside the finalized evaluation procedures and KPIs. As the evaluation task has recently started, we must await updates as the project progresses and further information becomes available.

User questionnaire data

The assessment of public acceptance for the PoDIUM platform, along with the Use Cases (UCs) demonstrated in the 3 Living Labs (LLs), will be conducted through impact assessment/user acceptance questionnaire-based surveys. These surveys will feature structured multiple-choice questions to facilitate straightforward processing and analysis. In certain instances, participants may be given the option to provide free-text responses for more detailed qualitative feedback. However, it will be carefully evaluated whether these data, and in what format, can be made available in compliance with GDPR regulations. The specifics of the questionnaires and their precise format will be outlined as part of Task 5.3: Public acceptance and impact assessment, scheduled to commence in month 20 (May 2024).

Internal administrative data

This kind of data refers to data produced by project management activities, such as meeting minutes, recordings, internal reports, data stored for historical purposes. It is collected by the management team, which includes the project manager, the WP- and task-leaders. Data is stored and shared between project partners by using a project management tool, which requires the authentication of the users (Redmine hosted by the project coordinator).

The internal administrative data is internal working material and will therefore be considered confidential for internal use in reporting, taking the PoDIUM ethical requirements, as listed in chapter 6, into consideration.

2.4. Data on project outcomes and studies

Data in this category is generated within the project for the purpose of reporting project outcomes from managerial, technical and scientific activities. This includes project deliverables, scientific and technical publications, videos and presentations. Such data may be useful for the general public, for example for potential future projects, which build on the work of PoDIUM as well as the industry and public bodies wanting to learn from PoDIUM outcomes. All the data within this category is provided in text format and possibly graphical representation. The overall volume of data in this category is expected to be minimal.

3. FAIR data

This section describes how data will be made findable, accessible, interoperable and re-useable (FAIR). FAIR principles are applied to research data and outputs in order to facilitate sharing and re-use of data, also in the long term, and to maximize the impact of research². Due to the specific characteristics of the different data categories described in chapter two, there are some differences between the data categories in how FAIR principles are applied. Because of this, in this chapter, FAIR aspects are described in separate sections for each of the data categories.

3.1. Technical data

For the data exchange across all UCs we use basic C-ITS messages, e.g. CAM traces for vehicle movements, DENM for traffic event communications, IVIM for traffic signs communicated from infrastructure to vehicles and CPM for communicating the dynamic data contents between various participants. Therefore, providing the respective message set for each single UC defined and performed in demonstrations makes it possible also for externals to have access to respective PoDIUM data sets and KPI values.

At the moment, the only data type that is fixed is C-ITS messages. Details of other technical data are being worked out in the specification in task 4.1. Therefore, information on the FAIR aspects for C-ITS messages is provided in this version of the DMP. Information on FAIR aspects of additional technical data will follow in updates to the DMP, when the content has been clarified.

Data will be made findable through:

- Direct links in research publications and deliverables.
- The PoDIUM website: Data are categorized and tagged with keywords and links.
- Keywords at Zenodo or participant repositories.

Keywords are carefully selected to make the data discoverable, e.g., when searching for research questions, UCs, C-ITS messages, etc.

C-ITS messages, specifically a selection of transmitted messages, are intended to be made accessible for various potential purposes. Task 4.1 is currently working on a solution to ensure the accessibility of this data. The general procedure for defining data collection and storage was discussed and established. This procedure includes the following steps:

² <https://www.openaire.eu/how-to-make-your-data-fair>

- Identification of the data relevant for logging, including the purpose and format of the data
- Definition of the logging scheme and format
- Definition of storage and APIs

The identification of the data is currently being carried out and the definition of the logging scheme will follow. Discussions are underway to determine the most suitable data storage solution. It is likely that a decentralized approach will be adopted (per use case or living lab) and if possible using the same or at least similar APIs.

These messages will be accessible either directly through participants' repositories for sharing research data or through portals such as Zenodo. Additionally, references to the corresponding standards will be made publicly available as metadata to aid in understanding the content of C-ITS messages. The standards used will be linked on the PoDIUM website, encompassing both freely available and paid options depending on the message. Documentation for extensions made within PoDIUM will be provided in the corresponding deliverables.

Interoperability is an important element of PoDIUM as this is key to facilitate the interaction between infrastructure and vehicle side. As the basis for CCAM research work at data level is the use of C-ITS messages, these are standardized by the International Organization for Standardization (ISO) and the European Telecommunications Standards Institute (ETSI). The respective communication profiles are openly available and published at infrastructure and at vehicle level – and these will be used in PoDIUM, since PoDIUM is also fully aligned with the C-ROADS approach. This ensures interoperability and the correct interpretation of data. In addition, any additional developments of the project, will build as much as possible on standardised elements. In the documents, a detailed explanation will be provided to ensure the correct interpretation. The potential extension of C-ITS messages, such as MCM, CPM and VAM will be made available via deliverables and technical papers, and be input to standardisation activities (in certain cases, due to copyright issues only references to the changes to the standards will be published). This information will be made available already in draft format. Information will be provided, if possible, via the website and Zenodo. Due to copyright issues some technical/scientific papers may instead be published via institutional repositories, which also follow the FAIR principles. Proposing only additions to already standardised messages shall guarantee as much interoperability and re-usability as possible.

Transmitted C-ITS data provided are free to re-use. The required information for usage are the standards and profiles and information on PoDIUM extensions as described above.

3.2. Evaluation data

Evaluation data is a subset of the data produced during the lifecycle of the project and will be produced in the evaluation tasks defined in WP5 (T5.1, 5.2 and 5.3). More specifically, data will be collected from attached (end-user-) equipment and the monitoring mechanisms following the experimentation procedures. The exact description of the evaluation data will be done within the separate tasks, T5.1, T5.2 and T5.3, which started in October 2023.

As described before, also information on the FAIR aspects for evaluation data will follow through updates of the DMP, when the evaluation tasks have been clarified. Following up on this, evaluation data will also be made findable through direct links in research publications and deliverables, the

PoDIUM website, where data are categorized and tagged with keywords and links as well as through keywords at Zenodo or other repositories from participants.

Accessibility for evaluation data will also be provided, either through Zenodo or directly through participants' repositories, linked on Zenodo. C-ITS messages for the various potential purposes will be made accessible either directly through participants' repositories for sharing data or through Zenodo. As for interoperability, standardized messages (in ISO and ETSI) and the respective communication profiles that are openly available and published, will be used for evaluation. Evaluation data provided is generally free to re-use. The required information for usage is the information given on the standards and profiles on PoDIUM extensions as listed above. Information will be provided via the PoDIUM website and via Zenodo.

3.3. User acceptance questionnaire data

The data collected from user questionnaire responses from pilots will also be made Findable, Accessible, Interoperable and Re-used as mentioned above with the clarification that any personal information of the user will be removed before publication.

3.4. Internal administrative data

Internal administrative data is accessible to all project partners, as described in the Project Management Plan (D1.1). Beyond this, FAIR criteria do not apply to internal administrative data.

3.5. Data on project outcomes and studies

All project deliverables, with the exception of the deliverables on business models (D6.2 & D6.3), Exploitation plans (D7.7 & D7.8) and the Exploitation report (D7.11) will be made publicly available via the PoDIUM website and the EC portal. The public deliverables may be re-used without limitations. The deliverables related to business models and exploitation will not be made publicly available because of conflict with the commercial interests of partners. Presentations & videos from public events and conferences will be made publicly available (as far as contractually permitted) and shared via the PoDIUM Website. In the case that the situation arises during the project were further data on project outcomes and studies conflicts with IPRs or commercial interests of partners, the individual situations will be assessed and any change will be documented in the future versions of the DMP.

Research publications will be made available, given the publishing body copyright agreement, in a machine-readable electronic copy with open access, at the latest upon publication, and deposited in trusted repositories listed in OpenAIRE (Open Access Infrastructure for Research in Europe), namely Zenodo, and/or institutional repositories of project partners. Due to copyright issues some technical/scientific papers may instead be published via institutional repositories, which also follow the FAIR principles. PoDIUM consortium partners will be free to choose between self-archiving ("green" Open Access) and open access publishing ("gold" Open access). Zenodo assigns a persistent identifier to publications made publicly available in the repository³, and so do the institutional repositories of the partners. The scientific publications may usually be re-used without limitations. Scientific publications will be licensed under the latest available version of the Creative Commons

³ <https://zenodo.org/>

Attribution International Public License (CC BY) or with licenses under equivalent rights. However, monographs and long text formats may be licensed under licenses excluding commercial use and derivative works, such as CC BY-NC and CC BY-ND. Information on any research outputs, tools, or instruments needed to validate the conclusions of the scientific publication will be made available via the repository.

For scientific publications, the following information will be included in the metadata: publication (author(s), title, date of publication, publication venue); Horizon Europe funding; grant project name, acronym and number; licensing terms; persistent identifiers for the publication, the authors involved in the action and, if possible, for their organizations and the grant, as well as, when applicable, persistent identifiers for any research output or any other tools and instruments needed to validate the conclusions of the publication. Metadata of scientific publications will be open and licensed under Creative Common Public Domain Dedication (CC 0) or equivalent licenses.

4. Data protection and ethical aspects

This section describes data protection and ethical aspects and details the methodology to be followed to reach compliancy with data protection regulation and consideration of ethical aspects.

The project activities will adhere to the Helsinki Declaration and the Ethics of Information and Communication Technologies report (2012) from the European Group on Ethics in Science and New Technologies to the EC and will conform to the Charter of Fundamental Rights of the EU. All the data processing activities will comply with the requirements of GDPR, as described in the Grant Agreement (chapter 15.2 - Data processing by the beneficiaries).

PoDIUM will conduct anonymous surveys among participants in the UC demonstration. These questionnaires will not collect any personal data from the participants, but only information related to their opinions and attitudes towards the use of the proposed demonstrated services and towards CCAM in general. User acceptance questionnaires will be collected only locally by the local Living Lab (LL) partners and only anonymized data will be exploited at project level. The data to be processed will be relevant and limited to the purposes of the project (in accordance with the "data minimization" principle). According to the objectives and methodology of PoDIUM there are no ethical concerns arising from the implementation and execution of the project since no personal data are required in the user acceptance part or the evaluation and demonstration phases of the project.

Participants enrolled within the project's studies will be able to provide informed consent and will sign an age- and language-appropriate consent prior to each new study/demonstration. The participants will not include potentially vulnerable groups, minors or any other persons who are unable to give informed consent. The completed informed consent forms and information sheets (explaining the scope in language and terms intelligible to the participants) will be kept on file. Participants will also be provided with clear opportunities to provide feedback regarding their participation. The informed consent form will collect only essential personal information, specifically the participant's first and last names and, if necessary, their age.

5. Data security

This section describes the approach towards guaranteeing data security.

The PoDIUM consortium is aware of the significant potential risks related to data security, in particular during data collection and exchange. Among others, these have been integrated in the risk assessment performed at the beginning (M03) of the project, specifically identified in deliverable D1.2, “Quality Assurance and Risk Management”.

Cyber-security and privacy principles will be applied to all the data categories. Therefore, general methodologies and principles concerning end users need to be set up. Involvement of end-user in test activities will be carried out in a responsible way by providing a briefing on the project and the test activities, including information about potential risks.

5.1. Secure data collection

The following security principles will be implemented to achieve the best protection against any type of modification:

- **Authentication:** Users accessing data servers must undergo authentication processes to verify their identity. Additionally, the servers themselves must undergo authentication to ensure their legitimacy and integrity within the network.
- **Authorization:** Access to data servers is restricted to authenticated and authorized users. User categories and their respective rights are predefined and enforced to ensure only authorized users have access. Access control mechanisms are identified for each trial site and project-wide to enforce authorization protocols effectively.
- **Accounting:** Comprehensive logging of all user access and modifications to resources is essential for accountability. Secure logs prevent users from denying their actions, ensuring accountability for any accessed, altered, or deleted data files.
- **Confidentiality:** Data stored on servers must be encrypted during transmission and storage to protect against unauthorized access. Encryption ensures that even if data is intercepted, it remains secure and confidential.
- **Communication Security:** Access to servers should occur via encrypted communication channels, such as HTTPS, to prevent eavesdropping and ensure the integrity of data in transit. Encrypted channels provide an added layer of security against data interception and manipulation.
- **Availability:** Security measures must guarantee that data on servers remains available to authorized users throughout the defined service period. Regular backups of data ensure data availability and integrity, allowing for swift recovery in the event of data loss or corruption.

For many data communication scenarios, it is very important to verify the authenticity and integrity of the messages containing information such as position and heading. This authenticity and integrity allow assessing the trustworthiness of this sent information.

5.2. Secure data storage

All logged data generated during the project, including those at the evaluation and demonstration events of PoDIUM, will be securely stored locally in the servers of each partner involved in data collection and generation. Any user questionnaire responses (only anonymised data) from the demonstration events will be stored and regularly backed up through the internal collaboration tool 'Redmine': the Institute of Communication and Computer Systems (ICCS) is hosting a Redmine installation under: <https://redmine.iccs.gr/>, where a dedicated project area has been created for PoDIUM. The web access to <https://redmine.iccs.gr/> is secured using a digital certificate from TERENA (<https://www.terena.org>). The server hosting the Redmine installation is located in the ICCS premises in Athens, Greece, in a secured rack in the ICCS server room. The server databases are backed up daily, while its files are backed up every second day. The server is built with multiple redundancies, network and disk-wise, in order to ensure its constant operation and network access. Third-party services like Dropbox and Google Drive will not be used for sensitive data storage and sharing.

During the course of the project, data will be shared among partners as determined appropriate by the partners themselves. Potentially sensitive data will only be stored locally in conformance with GDPR, the consortium agreement and the internal consortium procedures as specified in D1.1 – Project management plan and D1.2 - Quality Management Plan.

Data that is produced during the runtime of the PoDIUM project will be stored in local and central servers during the duration of the whole project. It will be treated as confidential and security processes and techniques will be applied to ensure their confidentiality in compliance with the regulation on the protection of private data (GDPR).

6. Other research outputs

This first version of the DMP contains information that is currently available and is a general guidance on the management of other research outputs. For the next version of the DMP, a plan for the management of potential other research outputs will be created, according to the output of the individual pilots.

This section describes the management of other research outputs, as outlined in the Horizon Europe DMP template and Annex 5 in the Grant Agreement (this can be for example software, algorithms, protocols, models, workflows and electronic notebooks). In particular, this section explains how research outputs, which will be generated or re-used in PoDIUM, will be managed, shared and made available for re-use, in line with the FAIR principles.

In the case of PoDIUM, examples where this may be relevant are: perception models, traffic management schemes, digital solutions and others.

At present, no further research initiatives have been identified nor deemed applicable for inclusion in this initial version of the DMP. As such, this section on the management of other research outputs remains closed. However, should any additional research outputs emerge or become relevant throughout the course of the project, they will be duly addressed and incorporated into the final version of the DMP and considered in future projects. The forthcoming iterations of the DMP will be

adapted to encompass any newfound insights or developments, ensuring comprehensive coverage of all research outputs in line with the evolving needs and objectives of the PoDIUM project.

7. Allocation of resources

At the current stage, it is not possible to estimate what all the costs for making data and other research outputs of PoDIUM FAIR will be, or how the costs will be covered. This aspect will be detailed in the future version of the DMP.

The data used in PoDIUM will be generated and collected as part of the project activities in the UCs. Task 1.3 is dedicated to data management and is led by AustriaTech, who is also the Data Management and Protection Officer (DMPO) of the project. The DMPO coordinates the Data Management Plan and raises potential issues and proposes solutions for dealing adequately with data privacy and data protection regulations and will liaise with the partners who will perform the trials to establish procedures that ensure the proper application of the data protection policies at the national level. The DMPO is responsible for defining procedures to ensure that data is managed following FAIR principles, in a secure and GDPR compliant way. PoDIUM partners are responsible for collecting, managing and sharing data according to the guidelines and procedures detailed in the DMP.

Budget allocated under Task 7.2 of the project supports the production and publication of scientific and technical publications. For long-term preservation of data, one low-cost option is storing data in a repository, such as Zenodo, which is free of charge. Zenodo, operated by CERN, serves as a digital repository and data-sharing platform facilitating open access principles and ensuring the long-term preservation of research outputs, including datasets, software, presentations, and papers. It is not foreseen that PoDIUM partners will make use of other national/funder/sectorial/departmental procedures for data management. If other national/funder/sectorial/departmental procedures for data management will be used in the future, this will be described in future versions of the Data Management Plan.

8. Conclusions

In summary, the Data Management Plan for the PoDIUM project lays out a comprehensive strategy for managing its diverse data generated throughout the activities. It focuses on various data types including technical, evaluation, user acceptance, and project outcome data. The plan is designed to adhere to FAIR principles, ensuring data is Findable, Accessible, Interoperable, and Reusable whenever possible. Moreover, stringent measures are in place to uphold data privacy in accordance with GDPR regulations, ensuring anonymity and obtaining informed consent for user participation. Data security is also a top priority, with robust measures implemented to safeguard data throughout its lifecycle. By promoting responsible data handling practices and facilitating data sharing, the PoDIUM Data Management Plan not only supports the project's goals but also lays a foundation for future research in connected and cooperative automated mobility.