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6 Ethical and Deontological Concerns

6.1 Introduction

This chapter examines the ethical, deontological, and legal dimensions of the CONNECT and share installation. It evaluates the project's impact on public transport users, ensuring that the design choices align with principles of privacy, inclusivity, and social responsibility.

It covers:

- **Engineering Ethics:** An analysis of passenger interaction and consent, focusing on data privacy (the non-collection of personal data in Phase 1 versus message storage in Phase 2) and accessibility concerns.
- **Sales and Marketing Ethics:** An evaluation of the project's funding models (public interest versus commercial sponsorship), highlighting the need for transparency and the protection of user-generated content from commercial exploitation.
- **Environmental Ethics:** Reflection on the ecological footprint of the chosen hardware and infrastructure. Addressing use of Nanovia PA Rail, the management of electronic waste, and the energy consumption of web hosting.
- **Liability:** A discussion on the distribution of responsibility regarding physical and electrical safety in a traffic transit environment, and accountability for moderating potentially harmful user-generated audio content.
- **Summary:** The final conclusions detailing the specific design, material, and technical choices implemented by the team to uphold these ethical standards.

6.2 Engineering Ethics

CONNECT and share is designed to interact with passengers in a shared public space. This raises questions about professional responsibility, user consent, and inclusive design. The Institute of Electrical and Electronics Engineers (IEEE) Code of Ethics requires engineers to hold paramount the safety, health, and welfare of the public, and to protect the privacy of others [1]. These principles work as a guidance when the team approaches passenger interaction and data handling throughout the project.

Informed interaction and passive consent

Passengers interact with the installation by gripping a handrail, which is an action they would perform regardless of the installation's presence. To ensure that passengers are aware of the installation, an informational notice is placed on the carriage door. This approach provides passive consent: passengers are informed before entering, and their engagement remains voluntary. No active sign-up or agreement is required. Since Phase 1 collects no personal data, the installation falls outside the scope of the EU General Data Protection Regulation (GDPR) [2], which applies only where personal data is processed.

Privacy and data minimisation

In Phase 1, the system uses velostat pressure-sensitive sheets to detect grip. Velostat registers physical pressure only: it does not identify who is pressing, collect biometric data, or transmit any personal information. No data is stored or logged at any point in Phase 1. This distinguishes the system from biometric sensing technologies and minimises privacy risk, in line with the principle of

data minimisation established under the GDPR [3].

In Phase 2, passengers may voluntarily choose to submit a message via a web platform accessed through a QR code near the exit doors. Participation is entirely optional. However, messages constitute personal user-generated content, and the platform must handle this responsibly in accordance with the GDPR [4]. Messages are transcribed and reviewed through automated content moderation tools prior to being made available on the platform. Questions of data ownership and retention period should be clearly communicated to users on the platform.

Accessibility

The installation relies on passengers gripping a handrail. To ensure that the experience is accessible to all passengers, including those who use wheelchairs, mobility aids, or who cannot reach a standard handrail, a pressure-sensitive point is located at a lower position on the pole. This allows passengers to interact with the installation regardless of height or mobility. The visual output on the ceiling remains visible to all passengers whether or not they interact directly. Phase 2 is accessible to passengers with a smartphone.

6.3 Sales and Marketing Ethics

Although CONNECT and share originates as a student project within the European Project Semester at ISEP, it is developed and presented as a real product concept with potential for deployment in public transport systems. This framing means that ethical considerations around commercialisation are relevant. The IEEE Code of Ethics requires that engineers act in a manner that avoids deceptive acts and maintains honesty and integrity in all communications [5].

Potential customer types

Two types of customers have been identified. One is a municipality or public transport authority adopting CONNECT and share in the public interest represents a relatively unproblematic relationship: the installation's stated goal to reduce social isolation in public spaces aligns with the mandate of public institutions. A commercial sponsor introduces more complex considerations. If a private entity funds the installation, it is important that the sponsor's interests do not conflict with or overshadow the project's original purpose. Passengers should not be exposed to undisclosed commercial influence.

Transparency toward passengers

Regardless of who funds the installation, passengers should be clearly informed about the nature of the project and who is behind it. The informational notice on the carriage door serves this purpose. If the installation is commercially sponsored, this should be disclosed in that notice. Marketing the installation as a neutral public art piece while concealing a commercial interest would conflict with the principle of honest communication [6].

Data and commercial interests in Phase 2

In Phase 1, no user data is collected, which eliminates the risk of data monetisation. In Phase 2, messages are submitted voluntarily by users and constitute personal data subject to the GDPR [7]. A commercial sponsor must not have access to this content for marketing purposes. The team's position is that user-generated content in Phase 2 belongs to the platform and is used solely for the purpose of the installation, and not for commercial exploitation.

6.4 Environmental Ethics

Environmental responsibility was considered during the material selection and system design phases of the project. The choices made reflect an awareness of the environmental impact of the components used.

Enclosure material

The electronics enclosure is 3D printed using Nanovia PA Rail, a composite polyamide filament certified to NF EN 45545-2 for use in railway environments [8]. The material was selected for its fire safety properties, because it is non-flammable, low smoke, and low toxicity characteristics [9]. It is a petroleum-based polymer, which is not biodegradable, and end-of-life disposal should be handled accordingly. We were initially planning on using PLA, which would be biodegradable, but the safety requirements of the deployment was considered more important.

Electronic components

The system uses a WEMOS C3 Mini microcontroller (ESP32-C3-based), WS2812 addressable LED strips, MCP2551 CAN bus transceivers, and velostat pressure-sensing sheets, which are all electronic components. Their manufacture involves energy processes and can involve rare materials. As the system contains electronic components, it falls within the scope of the Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU), which requires that electronic waste is collected and processed through certified facilities rather than disposed of as general waste [10].

Phase 2 infrastructure

The web platform introduced in Phase 2 requires server hosting, which carries an associated environmental cost that should be acknowledged alongside the physical components of the installation.

6.5 Liability

Because CONNECT and share is installed in a public transport environment and involves direct physical contact by passengers, liability is a relevant concern. The following considerations apply to both phases of the project.

Physical safety (Phase 1)

Passengers grip handrails that contain embedded velostat sheets, wiring, and LED components. The materials must be safe for repeated physical contact and must not create electrical hazards. The electronics enclosure is designed to contain all active components, and the handrail surface presented to passengers should be free of exposed components. The General Product Safety Directive (GPSD) requires that all products placed in public use are safe and do not pose excessive risk to users [11]. The Low Voltage Directive (LVD) establishes safety standards for electrical equipment and applies to the electronic components used in the installation [12]. Responsibility for ensuring compliance lies with the team as designers, in coordination with the metro operator as the host environment.

User-generated content (Phase 2)

The introduction of a message platform in Phase 2 raises the question of liability for user-generated content. Passengers may submit messages that are harmful, offensive, or distressing to other users. Messages are reviewed through LLM content moderation API prior to being made available on the platform. The platform must also comply with the GDPR regarding storage, access, and retention of

data [13]. While automated moderation reduces risk, it does not eliminate it entirely. What kind of content that is not permitted need to be defined clearly for the user.

Sponsor and operator responsibility

If the installation is commercially sponsored or operated by a transit authority, the distribution of liability between the team as designers, the sponsor, and the metro operator should be clearly defined prior to any deployment. This is particularly relevant for Phase 2, where the platform hosts user content over time. The data stored need to be separated from commercial interests.

6.6 Summary

This chapter has examined the ethical dimensions of the Connect installation across engineering ethics, sales and marketing ethics, environmental ethics, and liability. The analysis informed a number of concrete design decisions.

Based on this ethical and deontological analysis, the team chose velostat pressure sheets as the sensing technology which does not store data and Nanovia PA Rail as the enclosure material, due to safety reasons. The team also adopted automated content moderation for the Phase 2 platform to mitigate the risks associated with user-generated content.

The team decided to design a solution with passive consent signage on the carriage door, an accessible sensor point at a lower position on the pole, no data logging in Phase 1, and a content moderation pipeline in Phase 2. The following chapter describes the development of the project.

[1], [5], [6] Institute of Electrical, Electronics Engineers, 2020. *IEEE Code of Ethics*.

[2], [3], [4], [7], [13] European Parliament, Council, 2016. *Regulation (EU) 2016/679 on the Protection of Natural Persons with Regard to the Processing of Personal Data*.

[8], [9] Nanovia, 2024. *Nanovia PA Rail – Technical Datasheet*.

[10] European Parliament, Council, 2012. *Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE)*.

[11] European Parliament, Council, 2001. *General Product Safety Directive 2001/95/EC*.

[12] European Parliament, Council, 2014. *Low Voltage Directive 2014/35/EU*.

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