

SFI Public Service Fellowship 2023

1. Name of Governmental Department or Agency
Centre for Excellence in Universal Design, National Disability Authority
2. Title of the Project
NDA1 EVA: Electric Vehicle Acoustics
3. Description of the Project
<p>The National Disability Authority (NDA), as the independent statutory body, provides information and advice to the Government on policy and practice relevant to the lives of persons with disabilities. We have a role to assist the Minister for Children, Equality, Disability, Integration and Youth in the co-ordination of disability policy. We work through our Centre for Excellence in Universal Design to promote the universal design of the built environment, products, services and information and communication technologies so that they can be easily accessed, understood and used by everyone, including persons with disabilities.</p> <p>As Electric Vehicles (EVs) become increasingly common on public roads, concerns about their quiet operation and their impact on road safety has grown. At low speeds, the lack of traditional combustion-engine sounds makes it difficult for pedestrians and cyclists to detect their presence, raising significant safety issues, especially for those who rely exclusively on auditory cues in mobility contexts. To address this, UNECE Regulation No. 138ⁱ now mandates that all new EVs in Europe be equipped with an Acoustic Vehicle Alerting System (AVAS). However, despite this regulatory governance, there remain significant technical shortcomings in how effectively AVAS performs in diverse real-world scenarios.</p> <p>In this project, the Centre for Excellence in Universal Design (CEUD)ⁱⁱ aims to investigate whether a universal-design approach could improve AVAS where a range of hearing abilities and a variety of environmental conditions are accounted for. The research question is whether it is possible to make AVAS more robust across a broader range of real-world use-cases by embedding psychoacoustic parameters and environmental metadata into the AVAS design chain and ultimately into an AVAS universal-design framework. The methodologies for exploring this question will closely align with ISO 16254ⁱⁱⁱ, which is the technical standard for informing UNECE Regulation No. 138. To this end, the Centre for Excellence in Universal Design aims to onboard a researcher who has expertise in acoustics, psychoacoustics, and active experience in ISO standardisation processes.</p> <p>The CEUD/NDA's objective, therefore, is to guide policy in respect of AVAS by providing empirical evidence to the ISO Joint Working Group (JWG) on AVAS standards^{iv} and to promote wider universal-design principles in its design chain. This will have the further effect of providing guidance at national level in respect of approaches to legislative and regulatory frameworks in respect of the acoustics of Electric Vehicles (EVs). Over the past number of years, The Centre for Excellence in Universal Design has led, and contributed to, development of standards both nationally and internationally. The Centre is ideally positioned to contribute significantly to this work thereby ensuring that the needs of people with disabilities are considered in the development of AVAS policy and standards as EVs become ever more ubiquitous. With the collaboration of an acoustics research</p>

expert, we will provide valuable insights into the design and implementation of auditory alerts that are effective for all users, including people with disabilities and older people. By promoting universal-design principles in AVAS development, the Centre for Excellence in Universal Design can help ensure that auditory alerts are accessible, usable, and effective for everyone, regardless of their abilities or disabilities across a wide range of environmental conditions.

4. Project Scope

The proposed project is a collaborative effort between the Centre for Excellence in Universal Design, the Technological University of the Shannon (TUS)^v, Future Mobility Campus Ireland (FMCI)^{vi} and the Person-Environment-Activity Research Laboratory (PEARL)^{vii} aimed at evaluating Acoustic Vehicle Alerting Systems (AVAS) on a range of Electric Vehicles (EVs). To achieve this goal, the CEUD will onboard an acoustic and psychoacoustic researcher to work with the team.

By partnering with TUS, FMCI, and PEARL, the project will have access to state-of-the-art facilities with both real-world and simulation facilities for testing transport and mobility concepts, designs, and integrations with wider Intelligent Transport System infrastructure. The test criteria will comply with those specified in the ISO 16254 standard and will monitor changes being proposed in its redrafting (ISO/CD 16254) currently under development by ISO TC 43/SC 1/WG 42, a Joint Working Group (JWG) between ISO TC 22 "Road Vehicles" and ISO TC 43/SC 1 "Acoustics - Noise".

The project team will gather rich datasets from environmental, acoustic, and vehicle sensors at both the FMCI test-track and the PEARL laboratory and will use a range of EV test models. This means that the project will be able to play an active role in shaping AVAS policy at a national, European and International level through its membership of the National Standards Authority of Ireland (NSAI)^{viii}, by contributing to ISO JWG core-experiments with robust empirical data.

5. Skills/Expertise Required

The Centre for Excellence in Universal Design has amassed significant experience in development of standards at European and International Level. In order to complete this project, the core skills required will be:

Knowledge of the key standards underpinning AVAS

Skills and experience in the design and implementation of experiments in the domain of acoustics particularly as they apply to Electric Vehicles

Skills in the analysis of experimental outputs

Excellent oral and written communication skills, and the ability to effectively communicate with a wide range of stakeholders

6. Expected Outputs of Project

Task One: Produce a comprehensive evaluation report on AVAS performance in test scenarios, the project deliverables will also include detailed technical specifications for AVAS systems tested on various EV models. These specifications will take into account different use-cases, including low-speed urban driving, rural-road driving, and parking-lot driving.

Task Two: the project team will develop guidelines for the integration of AVAS systems with emerging Intelligent Transport System (ITS) infrastructure. These guidelines will provide

recommendations for AVAS sound characteristics, volume, and timing to ensure effective communication of vehicle presence and movement to pedestrians, cyclists, and other road users.

Task Three: The project team will also produce a set of best practices for the deployment of AVAS systems, including considerations for installation, maintenance, and safety testing. These best practices will be based on insights gained from the project's real-world and simulation testing, as well as feedback from stakeholders in the EV industry and accessibility communities.

Task Four: the project team will publish its datasets in accordance with open FAIR data policies, making them accessible to other researchers and stakeholders. By sharing these data, the project aims to foster collaboration and innovation in the development of AVAS systems and to promote transparency and accountability in the evaluation of AVAS performance.

By providing empirical evidence to the ISO JWG on AVAS standards, the project team will aim to embed universal-design principles into evolving AVAS frameworks and to contribute to the development of a redrafted ISO 16254. This will ensure that auditory alerts for EVs are accessible, usable, and effective for everyone, including people with disabilities and older adults. If these contributions are accepted by international peers, the projects outputs will have direct impact on UNECE policy and regulation in Europe, and will contribute to the development of more inclusive and sustainable transportation systems.

7. Working Arrangements

The working arrangements will be in compliance with those in operation at the National Disability Authority/Centre for Excellence in Universal Design. At time of writing, a hybrid model is in operation which requires attendance at the place of business at 25 Clyde Road Ballsbridge for a minimum of two days per week, or as required for operational reasons.

8. Expected Timeline

12 month full-time

9. Contact Details

Naomi Oldenburg Senior Standards Officer CEUD National Disability Authority

ⁱ Regulation No 138 of the Economic Commission for Europe of the United Nations (UNECE) — Uniform provisions concerning the approval of Quiet Road Transport Vehicles with regard to their reduced audibility [2017/71] (OJ L 9 13.01.2017, p. 33, ELI: [http://data.europa.eu/eli/reg/2017/71\(1\)/oj](http://data.europa.eu/eli/reg/2017/71(1)/oj))

ⁱⁱ <https://nda.ie>

ⁱⁱⁱ ISO 16254:2016. "Acoustics — Measurement of sound emitted by road vehicles of category M and N at standstill and low speed operation — Engineering method." The International Organization for Standardization.

^{iv} ISO TC 43/SC 1/WG 42

^v <https://tus.ie>

^{vi} <https://futuremobilityireland.ie>

^{vii} <https://www.pearl.place/>

^{viii} <https://www.nsai.ie>