



## PhD in DESIGN - 41st cycle

**THEMATIC Research Field: ADVANCED INTERACTIONS IN AUTOMOTIVE EXPERIENCES:  
GENERATIVE UI SYSTEMS FOR DYNAMIC HUMAN-VEHICLE INTERACTION IN EVOLVING  
AUTONOMOUS ENVIRONMENTS**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1300.0**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

### Context of the research activity

#### Motivation and objectives of the research in this field

The automotive industry is undergoing a profound transformation driven by autonomous technologies, electrification, and digital innovation. As vehicles progress from Level 3 to potential Level 5 autonomy, the digital layer becomes increasingly critical in defining the mobility experience. This evolution fundamentally changes the relationship between humans and vehicles, requiring a complete reimagining of interaction paradigms. Traditional automotive interface design approaches are increasingly inadequate as vehicles become more autonomous and software-defined.

Key challenges include:

- \_ Creating seamless transitions between different levels of autonomy
- \_ Developing adaptive interfaces that evolve with technological advancements
- \_ Designing intuitive interfaces that reduce cognitive load while maintaining engagement
- \_ Enabling personalized experiences across multiple users and contexts

This research aims to establish a comprehensive framework for designing and developing generative and intelligent user interfaces that adapt to different autonomy levels, user preferences, and usage scenarios.

The project will investigate:

- \_ How generative AI can create dynamic, context-aware



	<ul style="list-style-type: none"> <li>_ How generative AI can create dynamic, context-aware automotive interfaces that learn from user interactions</li> <li>_ Methodologies for designing adaptive interfaces across varying levels of vehicle autonomy</li> <li>_ Integration of multimodal interaction patterns (voice, gesture, haptic) with visual interfaces</li> <li>_ Tools for rapid prototyping, testing, and evaluation of AI-driven automotive interfaces</li> <li>_ Inclusive design principles ensuring accessibility for diverse user groups</li> </ul> <p>By bridging theoretical frameworks with practical implementation strategies, this research will advance automotive interface design while addressing human-machine interaction challenges in increasingly autonomous vehicles.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research methodology will adopt a mixed-methods approach within an action-research framework, combining theoretical exploration with practical application in real-world contexts.</p> <p>Foundation and Exploration Phase:</p> <ul style="list-style-type: none"> <li>_ Comprehensive literature review covering automotive UX, generative AI in interface design, and human factors in autonomous vehicles</li> <li>_ Competitive analysis of current automotive interfaces across manufacturers and autonomy levels</li> </ul> <p>Expert interviews with automotive designers, UX professionals, and engineers</p> <ul style="list-style-type: none"> <li>_ Observational studies of users interacting with current automotive interfaces</li> </ul> <p>Framework Development Phase:</p> <ul style="list-style-type: none"> <li>_ Creation of a theoretical framework for adaptive automotive interfaces across autonomy levels</li> <li>_ Development of design principles and guidelines for generative UI in automotive contexts</li> <li>_ Establishment of evaluation metrics for assessing</li> </ul>



	<p>automotive user experiences</p> <ul style="list-style-type: none"> <li>_ Definition of methodologies for prototyping and testing generative interfaces</li> </ul> <p>Prototyping and Validation Phase:</p> <ul style="list-style-type: none"> <li>_ Design and development of prototype interfaces implementing the framework</li> <li>_ Laboratory testing using driving simulators to evaluate interactions</li> <li>_ Field testing in real vehicles (where possible) or advanced simulation environments</li> <li>_ Iterative refinement based on user feedback and performance metrics</li> </ul> <p>Integration and Dissemination Phase:</p> <ul style="list-style-type: none"> <li>_ Integration of findings into comprehensive design guidelines and tools</li> <li>_ Development of practical implementation strategies for automotive manufacturers</li> <li>_ Academic publication and industry dissemination of research findings</li> </ul> <p>Throughout all phases, the research will involve different stakeholders including automotive designers, engineers, UX professionals, and potential users through collaborative workshops and co-design sessions. The research will utilize state-of-the-art tools including advanced prototyping tools, eye-tracking and biometric measurement, machine learning tools, and high-fidelity driving simulators.</p>
<p><b>Educational objectives</b></p>	<p>The educational objectives of this doctoral project aim to develop a professionally versatile researcher capable of bridging theoretical knowledge with practical application in the evolving field of automotive user experience design:</p> <p>Research Competencies:</p> <ul style="list-style-type: none"> <li>_ Mastery of research methodologies relevant to UX design, HCI, and automotive interfaces</li> <li>_ Development of critical analytical skills for evaluating technological innovation</li> <li>_ Ability to design and conduct complex user studies in</li> </ul>



	<p>technological environments</p> <p>Technical Expertise:</p> <ul style="list-style-type: none"> <li>_ Proficiency in prototyping tools and methodologies for automotive interfaces</li> <li>_ Understanding of AI and machine learning applications in user interface design</li> <li>_ Knowledge of technical constraints and opportunities in automotive digital systems</li> </ul> <p>Design Leadership Skills:</p> <ul style="list-style-type: none"> <li>_ Ability to lead cross-functional teams in complex design challenges</li> <li>_ Capacity to translate research insights into actionable design strategies</li> <li>_ Skills in communicating complex technological concepts to diverse stakeholders</li> </ul> <p>Industry Knowledge:</p> <ul style="list-style-type: none"> <li>_ Understanding of automotive industry trends and technological roadmaps</li> <li>_ Awareness of regulatory frameworks affecting automotive interface design</li> <li>_ Familiarity with production constraints and implementation requirements</li> </ul> <p>The educational path will combine structured academic learning with hands-on experience in both academic and industrial settings, ensuring that the researcher develops as both a scholarly contributor and a practical innovator, capable of addressing the complex challenges of designing user experiences for next-generation vehicles.</p>
<p><b>Job opportunities</b></p>	<p>The interdisciplinary nature of this research project positions the PhD graduate for various high-demand career paths in both industry and academia:</p> <p>In the automotive industry:</p> <ul style="list-style-type: none"> <li>•UX Research Director or Lead UX Strategist at major automotive manufacturers</li> <li>•Innovation Manager specializing in digital experiences</li> </ul>



	<p>and interface design</p> <ul style="list-style-type: none"> <li>•Technical Product Manager for in-vehicle digital systems</li> <li>•Chief Experience Officer (CXO) focusing on next-generation mobility experiences</li> </ul> <p>In the technology sector:</p> <ul style="list-style-type: none"> <li>•Experience Design Lead for mobility platforms and services</li> <li>•AI Experience Designer specializing in intelligent interface systems</li> <li>•Consultant for digital transformation in mobility and transportation</li> <li>•Innovation Strategist for technology companies entering the mobility space</li> </ul> <p>In academia and research:</p> <ul style="list-style-type: none"> <li>•Research Professor specializing in automotive experience design</li> <li>•Principal Investigator for research programs on human-autonomy interaction</li> <li>•Director of automotive innovation labs or mobility research centers</li> </ul> <p>In entrepreneurial contexts:</p> <ul style="list-style-type: none"> <li>•Founder of startups focused on next-generation automotive interfaces</li> <li>•Developer of innovative aftermarket solutions for vehicle experience enhancement</li> <li>•Creator of specialized design studios focusing on mobility experience</li> </ul> <p>The acquired expertise in combining design thinking, technological innovation, and user-centered methodologies provides a unique professional profile that bridges multiple disciplines, making the graduate highly valuable in an industry increasingly defined by experience rather than mechanical specifications alone.</p>
--	--



<b>Composition of the research group</b>	1 Full Professors 3 Associated Professors 1 Assistant Professors 2 PhD Students
<b>Name of the research directors</b>	ARQUILLA VENANZIO

<b>Contacts</b>
E-mail: venanzio.arquilla@polimi.it 02 2399 5919

<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	650.0 €
<b>By number of months</b>	6

<b>Stage and period abroad</b>	
<b>Institution or company where the candidate will spend the period abroad (name and brief description)</b>	
<b>By number of months abroad</b>	0

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p>Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences) financial aid per PhD student per year: 5.300,25 euros per student (total for 3 years)</p> <p>Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student</p> <p>There are various forms of financial aid both for research and teaching activities. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.</p> <p>Computer availability: 1st year, 2nd year and 3rd year: Each research group may supply phd student with a laptop/desktop PC, if necessary.</p> <p>Desk availability: 1st year, 2nd year and 3rd year: Each research group may supply phd student with a desk.</p>