

**Ubiquitous Computing WiSe 2024**

**FINAL ASSIGNMENT 05: Application of ubiquitous/emerging technologies  
Issues and challenges**

**Marks: (50% of overall marks)**

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## **AI Tool Usage Declaration**

In accordance with academic integrity guidelines at Bauhaus-Universität Weimar, the following table outlines the AI tools used in the preparation of this report:

**Tool Used:** ChatGPT with DALL·E (OpenAI, 2025)

**Used For:** Mobile interface mockups of the NeuroBi application

**Used How (Prompts or Descriptions):** ``Generate four simple (black and white) mobile screens where the student can receive AR navigation to reach library, select payment method for a language course, get recommendation for a suitable sport course, and request dorm help before arrival."

**Rationale:** To provide low-fidelity design visuals that reflect key user flows, supporting the use case scenarios section

# NeuroBi: A Tangible Robotic Assistant Network for Supporting International Student Navigation and Campus Engagement at Bauhaus-Universität Weimar

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This report presents the conceptual design of *NeuroBi*, a tangible robotic assistant system aimed at easing the transition of international students arriving at Bauhaus-Universität Weimar. *NeuroBi* combines friendly kiosk-like robots, wearable bone conduction audio stick-ons, and a mobile AR-integrated app to help students navigate campus buildings, remember deadlines, and access real-time information at key locations. Rooted in user-centered design and personal experience as a student council member, the report explores the feasibility and impact of such a system, drawing from literature on calm computing, urban AI, and comic-style interaction. The project aligns with the values of ubiquitous computing by embedding intelligent support into everyday environments in an unobtrusive, context-aware manner.

Additional Key Words and Phrases: Ubiquitous Computing, Tangible Interaction, Bone Conduction, Calm Technology, Student Onboarding, AR Navigation, IoT

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## 1 INTRODUCTION

Arriving in a new country as a student can be both exciting and overwhelming. Across universities worldwide, international students often encounter disjointed infrastructures, unfamiliar administrative processes, and fragmented support systems. These challenges are especially pronounced in the first few days or weeks of arrival, when students are expected to make critical decisions and access services without fully understanding the institutional or cultural context. Bauhaus-Universität Weimar, where this concept was initially developed, is used as a primary case study to explore this issue in depth. Its uniquely decentralized campus layout, along with the presence of multiple independently managed services, mirrors common structural patterns seen across many universities globally. This report presents *NeuroBi* as a tangible assistant system inspired by the author's lived experience at Bauhaus, but applicable to a much broader context of onboarding and student support across academic institutions.

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## 2 LITERATURE REVIEW

*NeuroBi* draws upon diverse and cross-disciplinary literature at the intersection of ubiquitous computing, tangible interaction, wearable technology, and critical design studies. The conceptual foundation of the system is rooted in the idea of calm computing, first introduced by Weiser and Brown [1], which advocates for technologies that communicate information without being intrusive or attention-demanding. *NeuroBi* embodies this ethos by only responding when directly engaged and by minimizing visual and auditory disruptions in shared environments. A significant inspiration for the tangibility of *NeuroBi*'s physical interface comes from the work of Eva Hornecker, who describes the role of physicality and embodiment in interaction design [10].

Her reflections on the emotional, sensorial, and spatial dimensions of tangible computing underscore the need to design for more than just functional usability. *NeuroBi*'s combination of tactile screens, comic-style displays, and disposable ear stick-ons attempts to create an interface that is sensorially rich, yet accessible, unobtrusive, and culturally adaptable. The project also benefits from Hornecker's argument that tangible systems must be situated in lived space—recognizing the embodied and context-dependent ways students interact with their surroundings.

Bone conduction interfaces are central to *NeuroBi*'s innovation. As reported by the Centre for Hearing [2], bone conduction bypasses the eardrum to transmit vibrations directly to the cochlea, making it particularly effective for hearing-impaired users. Technologies like *Ludbeat One* [3], a Kickstarter project, have shown that ultra-thin, non-obstructive, adhesive headphones are feasible, at least in early form. These sources justify the claim that a disposable, battery-less ear stick-on is plausible in future iterations of the system.

Further, wearable auditory interfaces have often been framed in assistive technology research as pathways toward inclusive design. Recent studies (e.g., through CHI proceedings and health-centered HCI) demonstrate the value of bone conduction for those with hearing loss, offering both accessibility and privacy—two goals that *NeuroBi* prioritizes for international students navigating unfamiliar, multilingual environments.

From a human-centered urban technology perspective, *NeuroBi* is informed by Kaisa Väänänen's research on urban AI [4], advocating for AI systems that are embedded in physical contexts and serve public needs rather than merely commercial goals. The assistant units at various Bauhaus University locations—library, train station, dormitory, etc.—act as spatially grounded touchpoints for meaningful micro-interactions.

In terms of visual interaction design, the use of comic-style panels for the *NeuroBi* interface draws from Frauenberger's [5] work and findings in survey design practices, which highlight the importance

of culturally agnostic visual language. Comics offer metaphor, pacing, and relatability in ways that simple icons or menus cannot. They also support low-literacy and cross-cultural scenarios where textual instruction may fail.

To remain reflexive and critical, the system's design also considers the ethics of smart environments. Honan's dystopian narrative on connected homes [6], alongside Singh and Powles' critical perspective on IoT privacy [7], illustrate the risks of poorly designed ubiquitous systems. NeuroBi mitigates this through transparent data usage policies and voluntary engagement mechanisms.

The Guardian's article on smart cities [8] and Jacobs' MIT Technology Review piece on Toronto's Sidewalk Labs [9] further reinforce the necessity of participatory and accountable urban tech development. NeuroBi embraces a bottom-up design approach, rooted in lived experience, student feedback, and context-sensitive iteration. Inspired by Tobias Sonne's *ChillFish* [11], NeuroBi also considers the role of tangible systems in regulating emotional states. *ChillFish*—a biofeedback device to help children with ADHD self-regulate stress—demonstrates how tangible interaction can serve as emotional scaffolding. Similarly, NeuroBi aims not just to inform but to reassure and gently support overwhelmed newcomers.

Finally, the CUGO project [12], which combines tangible feedback and gamified reminders, illustrates the use of tangible agents in motivating users without overburdening them. CUGO's methodology aligns with NeuroBi's intention to nudge, not nag—using location-specific data to suggest actions, but never mandate them.

Overall, NeuroBi's conceptual backbone lies in tangible, embodied, and context-aware computing, strengthened by literature that spans interaction theory, accessibility, smart city critique, and ethical technology design. Through this survey, the report portrays NeuroBi as a scalable, human-centered system that promotes inclusion, empathy, and practicality in student onboarding experiences.

NeuroBi draws from established and emerging research in ubiquitous computing, wearable interaction, and urban AI design. The principle of calm computing, proposed by Weiser and Brown [1], informs NeuroBi's unobtrusive design approach, which avoids attention-seeking behaviors such as beeping or flashing. This reinforces NeuroBi's role as an ambient support tool rather than a disruptive presence.

Bone conduction interfaces offer a promising avenue for discreet and hygienic personal audio delivery. As outlined by the Centre for Hearing [2], such technologies transmit audio vibrations through the skull rather than air conduction. This supports NeuroBi's use of ultra-thin ear stick-ons, reducing the need for shared headphones or open-air speakers.

The Ludbeat One Kickstarter campaign [3] showcases a commercial push toward compact, adhesive wireless audio devices. Though still experimental, this supports the feasibility of NeuroBi's throw-away, battery-free design.

Human-centered urban AI, as emphasized by Kaisa Väänänen [4], promotes technologies that adapt to city infrastructures while serving community needs. NeuroBi adopts this ethos, integrating softly into the physical spaces students already use.

Design-wise, NeuroBi leverages comic-style interfaces to simplify interaction and enhance relatability. Frauenberger [5] and survey design literature advocate for visually empathetic design that reduces

the cognitive load, especially for culturally diverse or overwhelmed users.

However, the optimistic trajectory of such smart systems is tempered by critical literature. Mat Honan's dystopian story [6] warns of overly connected environments gone wrong, revealing the psychological and logistical overload of a hyper-connected life. Singh and Powles [7] question the inherent risks of the Internet of Things, particularly in poorly regulated spaces. The Guardian's analysis of smart cities [8] points out how residents can become unconsenting participants in data experiments. Similarly, Jacobs [9] documents how Toronto's Sidewalk Labs project collapsed under ethical scrutiny.

Together, these sources underscore the importance of designing NeuroBi not just for technical feasibility, but also for social accountability. Participatory design methods and ethical transparency should be baked into every layer of development. This could include visible opt-in points, transparency about data usage, and continuous co-design sessions with student groups from marginalized or underrepresented backgrounds.

NeuroBi thus becomes more than a convenience: it is a statement about what equitable, human-centered ubiquitous computing can look like in practice. Of these domains, offering a highly feasible and emotionally resonant response to real problems faced by international students.

### 3 APPLICATION CONTEXT AND PROBLEM STATEMENT

The core of the NeuroBi concept is grounded in a real, lived experience: the chaotic and disorienting arrival of international students to a decentralized campus like Bauhaus-Universität Weimar. Upon first arriving at Weimar Hauptbahnhof, many students find themselves in a new city with campus buildings dispersed across different neighborhoods. While general signages and onboarding materials exist, students often face challenges when they encounter location-specific doubts or unexpected situations, moments when it becomes difficult to find quick, reliable answers without prior local knowledge or immediate access to support. What should feel like a welcoming moment often becomes a logistical maze.

From the author's own experience as an international student and through sustained involvement in the F&R Medien (student council) and university senate, it has become clear that these disorientation issues are neither unique nor rare. Instead, they are systemic and repeated every semester. Dozens of incoming students have shared similar experiences, ranging from confusion about where to pick up their Thoska ID cards to missing critical deadlines for language course registration due to a lack of visibility.

At Bauhaus, as in many universities around the world, multiple services operate independently, the International Office, Language Centre, University Library, Sport Centre, and student council office, each housed in different buildings and following their own administrative timelines. Important notices are often posted on physical bulletin boards, dispersed across various websites, or shared through mailing lists that new students may not yet be subscribed to. For international students, especially those unfamiliar with local languages or university norms, this decentralized communication structure can become a significant barrier. Many students report

feeling hesitant to ask questions at counters, particularly when navigating unfamiliar cultural and linguistic environments.

Navigating this distributed campus layout can make onboarding more logistically complex for incoming students, especially those unfamiliar with the city or institutional systems. Many find themselves walking across town to complete essential tasks, such as collecting welcome bags, registering for sports courses, or locating available study rooms. In some cases, students have missed critical service hours, like the 2 p.m. cutoff for Thoska card collection, resulting in the need for temporary overnight accommodations. While multilingual signage is available across most locations, students often struggle with accessing context-specific procedural information, such as how to reach the Hausmeister, register a payment, or operate shared facilities like laundry rooms, especially when no one is immediately available to assist.

Furthermore, Bauhaus is now actively expanding its target student base to include high school students and community learners, making the need for a robust and user-friendly onboarding infrastructure more important than ever. With this context in mind, NeuroBi is positioned not just as a solution for today's onboarding problems, but as a foundational infrastructure for the university's inclusive future.

The challenges extend beyond navigation and access to information. The emotional toll ranging from anxiety and loneliness to decision fatigue, can make the first few weeks of university particularly overwhelming. In this sense, NeuroBi serves a dual purpose: reducing the informational friction of campus life and offering calm, ambient emotional support during the early stages of adaptation. Unlike universities with centralized or enclosed campuses where key academic and administrative facilities are grouped together in a contiguous space (e.g., IIT Bombay or MIT) Bauhaus-Universität Weimar operates across a historically dispersed urban setting. Its departments, offices, and support services are embedded throughout the town, often in repurposed buildings.

For new students, especially those unfamiliar with the geography or language, this layout can complicate early interactions with the university. Students may struggle to locate offices, understand course enrollment procedures, or find available study spaces all while facing multiple simultaneous transitions, including navigating:

- Intermittent staff presence in student-facing services, such as the university's Language and Sports Centres.
- Language barriers and lack of translation support
- Scattered or delayed communication of critical deadlines (e.g., DAAD-funded language course registrations, elective sign-ups)
- Hesitation or anxiety about asking for help in unfamiliar cultural contexts

These environmental and structural challenges can amplify feelings of disorientation and isolation, particularly for international students, and highlight the need for ambient, context-aware support mechanisms like NeuroBi.

As a student senate and student council member, the author has engaged with dozens of new students over the last two semesters, observing recurring pain points in orientation and daily life. The

need for a support system that supplements human assistance, particularly during off-hours, is clear.

## 4 METHODOLOGY

To develop NeuroBi as a context-aware, tangible assistant system, a combination of autoethnographic reflection and bodystorming techniques was employed. These methods helped ensure that the design was not just theoretically grounded but also rooted in lived student experiences and spatial realities at Bauhaus-Universität Weimar.

### 1. Autoethnography

Autoethnography is a qualitative research method that uses the researcher's own experiences as a lens for exploring cultural, social, or systemic phenomena. It is particularly useful for uncovering embodied and emotional aspects of user experience that might not be accessible through detached observation [13]. The initial ideation for NeuroBi emerged from the author's personal experience as an international student navigating the logistical and emotional challenges of arriving in Weimar. Drawing on memory, informal conversations with fellow students, and insights gained as a member of the student council and university senate, the author used autoethnographic methods to identify recurring friction points in the onboarding journey. Particular attention was paid to moments of disorientation, missed deadlines, and the lack of contextual, real-time assistance across dispersed university services. This reflective process informed the creation of seven use case scenarios representing key moments in the first 48 hours of student life — from arrival at Weimar Hauptbahnhof to course registration at the Language Center. These scenarios were later visualized using comic-style sketches to promote empathy and cross-cultural relatability. Please note, all comic panels/sketches have been attached separately on a cloud folder as this format is not the most compatible for longer-length comics [18].

### 2. Walk-Storming with Annotated Map of Weimar

Walk-storming (a form of bodystorming) involves walking through a physical environment while simulating how a user might interact with a proposed system. It helps researchers consider spatial, sensory, and contextual cues that might influence user experience [14]. To complement the first reflective method, a bodystorming exercise, specifically walk-storming, was conducted to simulate user interactions with NeuroBi in real-world contexts. The author navigated through actual university locations, including:

- Weimar Hauptbahnhof
- International Office
- Carl-Ferdinand-Streichhan-Straße 4a (used as a dormitory example)
- M18 Office
- University Library
- University Sports Centre
- Language Centre
- Additional dormitories frequently used by international students

Each location was documented on an annotated digital map of Weimar, with an accompanying legend explaining NeuroBi's proposed placement and function at each site. For every marked point,

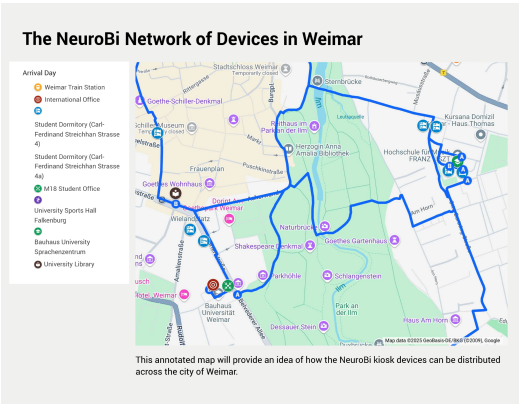


Fig. 1. An annotated map of the city of Weimar showing where the proposed kiosks could be located. Map file accompanied with embedded images and voice notes attached in appendix [15]

the author recorded voice notes expressing real-time thoughts, impressions, or challenges as a first-person user. These were accompanied by photographs of the actual locations, embedded into the map file. This spatial exploration helped validate the feasibility and interaction flow of NeuroBi’s physical components. It also highlighted practical considerations — such as foot traffic patterns, signage visibility, and kiosk accessibility — that could inform future design iterations.

## 5 TECHNICAL SOLUTION SKETCH

NeuroBi is envisioned as a distributed, multi-modal assistant system designed to support students across the spatially dispersed landscape of Bauhaus University Weimar. Drawing from principles of ubiquitous computing, calm interaction, and human-centered design, the concept proposes a layered infrastructure of physical kiosks, wearable interfaces, and mobile augmentation.

At this stage, the system remains a speculative design hypothesis. The goal is not to present a finalized blueprint, but to explore how various forms of embedded intelligence might collectively reduce onboarding friction for new students. The following technical sketch outlines the system’s three interdependent layers, acknowledging that their feasibility, usability, and institutional alignment still require validation through prototyping and field testing.

The system architecture includes:

- (1) A physical interface layer, comprising situated kiosks and tangible interactions at key campus locations (e.g., Weimar Hauptbahnhof, the University Library, M18 office).
- (2) A digital interaction and communication layer, which includes the mobile application and software interfaces that enable real-time guidance through AR navigation, voice or chat-based queries, and on-device continuity across platforms. This layer ensures users can access NeuroBi’s services both while on campus and in transit.
- (3) A technology-based backend infrastructure, responsible for securely handling data exchange, storing user preferences and interaction histories, and syncing content across all NeuroBi

devices. This backend would operate via cloud computing services, API endpoints, and secure authentication protocols, with minimal reliance on human administration.

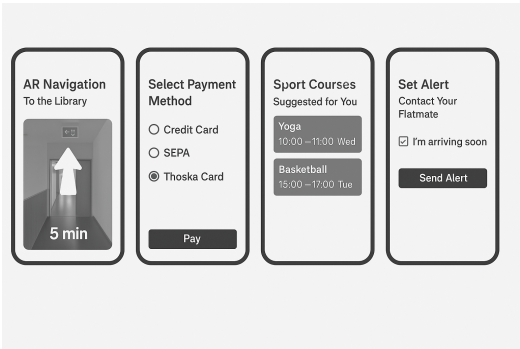


Fig. 2. An LLM-generated image of the UI Interface of what the interface of the app that students can use when they are near the kiosk. The declaration of AI usage and prompt has been found in the appendix [16]

## Backend and Data Architecture

NeuroBi would be powered by a campus-scale backend platform, potentially hosted on university-managed infrastructure or a secure academic cloud (e.g., an Eduroam-authenticated AWS/GCP setup). Key functions of this backend would include:

- Storage of user history, location-specific interactions, and personal timelines
- Content delivery for real-time location-based announcements
- Synchronization across physical kiosks and mobile interfaces

NeuroBi’s backend infrastructure would rely on secure, real-time communication protocols to synchronize data across devices. Lightweight methods such as RESTful APIs and MQTT messaging could facilitate fast and structured interactions, while authentication would be handled via standards like OAuth2 tied to university login systems. These implementation details support a system architecture that is both modular and adaptable — though full technical validation is outside the scope of this conceptual design report.

**IoT Integration Model** NeuroBi operates as a networked Internet of Things (IoT) system. Each kiosk functions as a semi-autonomous node, capable of logging anonymized usage data and operating offline temporarily if connectivity is interrupted. Students would have the option to opt-in to data personalization, allowing NeuroBi to remember preferences such as language settings, assistance type, or location-specific usage patterns. For instance, a student who previously interacted with NeuroBi at the Language Center might see a reminder about upcoming registration deadlines at a different kiosk the following day. This modular IoT architecture enables phased deployment: starting with high-impact areas (e.g., Weimar Hauptbahnhof, the university library), then scaling to other buildings and support services. Because each node is only loosely coupled with others, the system maintains resilience while allowing localized customization. The architecture is also shaped by principles of calm computing [1], ensuring that NeuroBi never overwhelms or distracts the user, but instead blends quietly into their environment, responding only when directly engaged.

## 6 NEUROBI SYSTEM COMPONENTS

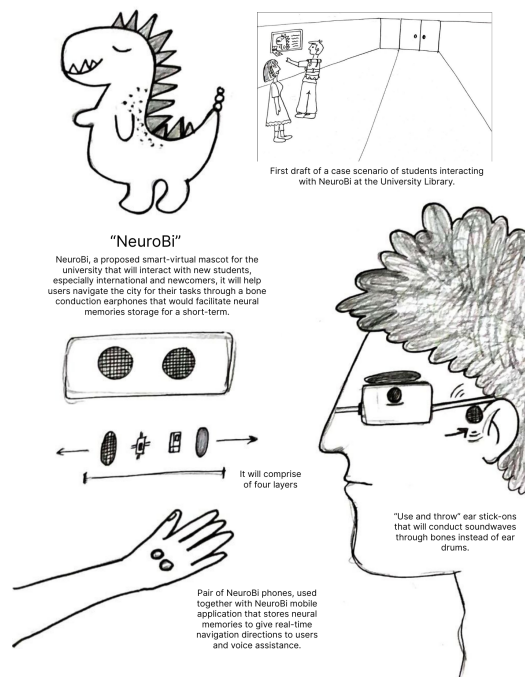


Fig. 3. Early Concept Sketch of the NeuroBi Assistant System. This scanned sketch represents the earliest ideation phase of NeuroBi, where the assistant was first envisioned as a distributed, AI-powered mascot offering tangible and wearable support for onboarding new students. The concept introduces a set of "use-and-throw" bone conduction ear stick-ons that bypass traditional earbuds by transmitting audio via the bones near the ear. These devices were imagined as battery-free, hygienic, and activated through lightweight contact with a dispensing robotic kiosk. The sketch also references a companion mobile application storing "neural memories" — a metaphorical framing for user history and personalized assistance. This early framing laid the groundwork for NeuroBi's later layered architecture, combining robotic screens, wearable audio, and augmented guidance. While many of the ideas shown are speculative, they reflect the initial design intuition: that onboarding should be emotionally supportive, ambient, and human-centered, rather than procedural or app-centric.

At this stage in the conceptual development of NeuroBi, three core components have emerged as promising directions for addressing the onboarding challenges of new students in a decentralized university environment. While these components are not finalized solutions, they represent complementary layers through which tangible and ubiquitous support might be delivered. Each of these elements carries open questions around feasibility, usability, integration, and institutional scalability, questions that would require iterative prototyping and real-world testing to resolve.

1. Robotic Screens (Situated Tangible Interfaces) The first and most visible layer of the NeuroBi system takes the form of context-aware robotic kiosks placed at critical points across the university ecosystem — such as the train station, M18 office, library, or

dormitories. These units are envisioned as friendly and intuitive, incorporating:

- A touchscreen interface with comic-style graphics [5]
- A physical lever to release audio stick-ons
- QR-code based authentication for personalization
- A limited range of gesture-based animations through a digital mascot

From a design standpoint, these kiosks are intended to augment but not replace human staff, particularly in off-hours or high-traffic moments. However, challenges remain around how much autonomy or intelligence these screens should display, how users will respond to animated gestures, and whether the combination of physical lever and digital interface is ergonomically sound. Moreover, the placement of such kiosks in semi-public spaces raises questions about pedestrian flow, distraction, and perceived approachability — areas that need observational studies and bodystorming exercises to explore in depth [10].

2. Bone Conduction Ear Stick-ons (Private, Disposable Audio Interface) The second component proposes a speculative audio interface in the form of adhesive bone conduction ear stick-ons. This idea draws inspiration from early-stage commercial prototypes such as Ludbeat One [3], hearing aid literature [2], and speculative design trends in wearable computing. These stick-ons are imagined to be:

- Ultra-thin and disposable (to avoid sanitation issues)
- Battery-free, potentially activated via near-field charging at kiosks
- Capable of delivering language-sensitive, private audio prompts

The goal here is to provide non-intrusive, on-demand guidance without requiring users to download apps or wear visible hardware. Bone conduction audio, already used in assistive devices for the hearing-impaired [2], offers a plausible path toward inclusive audio delivery. However, questions remain about material comfort, user perceptions, and whether first-time users would find the affordance of "sticking something on your ear" intuitive or strange. Low-fidelity paper prototypes and simple bodystorming videos could begin exploring these perceptions with actual students.

3. Mobile App with AR Navigation (Distributed Digital Layer) The third and most flexible layer of the system is a mobile application that complements the physical installations. Its intended features include:

- AR-based navigation (inspired by Google Live View or campus AR wayfinding apps)
- Chat and voice interaction with NeuroBi's backend [4]
- Notifications for deadlines, room availability, and event prompts

This app functions as a continuity mechanism, offering support when the user is away from kiosks. While mobile AR has become increasingly viable, deploying it across Bauhaus' architecture (notably its older buildings) raises questions of signal reliability, battery usage, and interaction simplicity. Moreover, the design must avoid digital overload. As noted in critiques of smart urban environments [6][8], over-automation without adequate control or transparency can backfire. User trust and opt-in mechanisms must be designed thoughtfully.

Another open challenge is how to keep the system lightweight: should the app be deeply integrated into the university's infrastructure (e.g., via Eduroam, Nextcloud, Moodle or portals), or remain separate to allow for modular prototyping? These decisions would have long-term implications for privacy, data governance, and institutional buy-in.

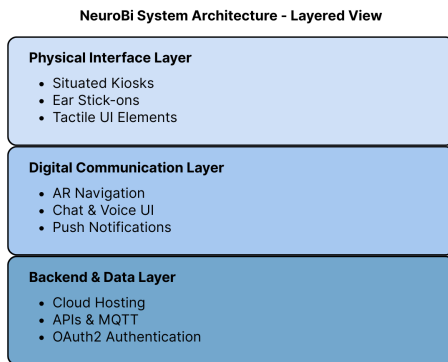


Fig. 4. Layered System Architecture of NeuroBi Showing the Hierarchical Relationship Between Physical Interfaces, Digital Communication, and Backend Infrastructure This diagram illustrates how NeuroBi's three functional layers operate in coordination: the bottom layer represents backend services managing cloud storage, messaging, and secure authentication; the middle layer handles real-time communication via AR navigation and chatbot interfaces; and the top layer engages directly with users through situated kiosks, wearable audio devices, and tactile input.

## 7 USE CASE SCENARIOS

This section illustrates how NeuroBi accompanies a new international student through their onboarding journey at Bauhaus University Weimar. The fictional student, Kyle, represents the collective experience of newcomers navigating a decentralized campus, unclear processes, and cultural unfamiliarity. These scenarios are grounded in autoethnographic insights drawn from the author's own onboarding at Bauhaus-Universität Weimar, as well as informal feedback from fellow newcomers. The narrative illustrates how NeuroBi could offer ambient and context-specific support across a range of academic and administrative encounters during a student's first 24–48 hours in Weimar.

### 7.1 Arrival in Weimar – Weimar Hauptbahnhof

Kyle, newly admitted to Bauhaus-Universität Weimar, arrives at Weimar's main train station carrying luggage and expectations. He immediately notices a NeuroBi kiosk near the station exit, as referenced in his acceptance letter. After pausing in front of the screen for a few seconds, the device waves at him through an animated mascot and points toward a squeezable arrow lever situated at its base. Kyle presses it and receives a pair of disposable bone conduction ear stick-ons. Once worn, NeuroBi greets him in his chosen language and prompts him to authenticate using the QR code from his welcome email.

The screen now provides a personalized “To-Do List” and offers real-time AR navigation via the NeuroBi app to help Kyle find his way to the International Office. This seamless, friendly interaction sets the tone for the rest of his journey.

This scenario was chosen as the starting point because it reflects a common and often disorienting first moment for many international students, including the author, upon arriving in the city. The depiction draws from personal experience and informal conversations with fellow newcomers, aligning with an autoethnographic approach to uncover overlooked pain points in the early onboarding journey. By tracing the user's path from the point of arrival, the scenario helps to illustrate the potential of NeuroBi to offer meaningful assistance from the very first step into a new environment.

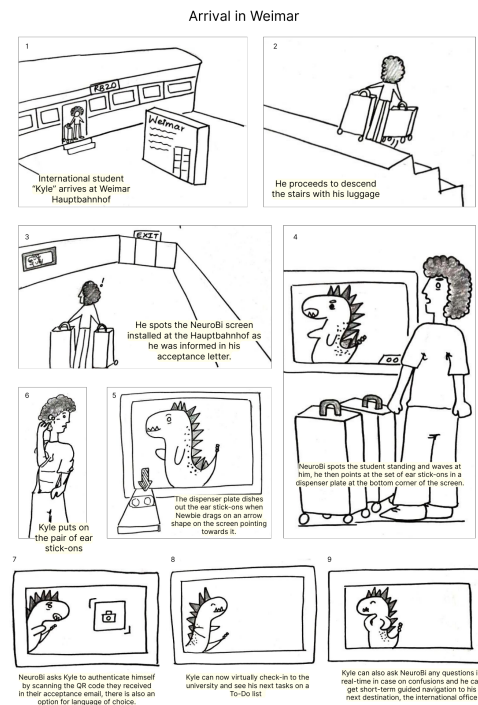


Fig. 5. Use Case Scenario of a new student arriving in Weimar city for the first time.

### 7.2 Guidance to the International Office

With his first interaction complete, Kyle follows NeuroBi's guidance to reach his next destination: the International Office. While on his way, Kyle boards a bus. Through the ear stick-ons, NeuroBi guides him on where to get off and when to switch transport. Using voice-based assistance and AR overlays on his mobile app, Kyle navigates easily through unfamiliar streets. Upon reaching the International Office, he discovers that it's closed. However, the nearby NeuroBi kiosk compensates for staff absence — helping him send a notification to his Hausmeister, and issuing a temporary digital Thoska ID valid for three days.



Fig. 6. Use Case Scenario of a new student going to the International Office

### 7.3 Dormitory Check-In

Although his Hausmeister is not working today, the NeuroBi device provides alternatives, allowing Kyle to proceed confidently to his dormitory. Kyle reaches his dormitory, where a dorm mate is waiting. Kyle was able to alert his flat mates of his arrival through NeuroBi. Thanks to the temporary ID arranged by NeuroBi, he's able to enter the building. This interaction, while short, reflects the system's ability to intervene meaningfully during gaps in human support.



Fig. 7. Use Case Scenario of a new student travelling to their dormitory

### 7.4 Collecting the Fresher's Totebag – M18 Office

After settling in, Kyle heads out again to visit the M18 Office, a central point for student-run activities and welcome events. Next, Kyle visits the M18 Office, where fresher's bags and event flyers are distributed by the student council. Upon entering, he initially struggles to locate the kiosk. Once found, NeuroBi allows him to virtually check-in with the student tutor responsible for bag distribution. He also explores event listings, club meetings, and flyers, gaining insight into campus culture, all without having to ask anyone face-to-face.

### 7.5 Library Exploration – University Library

Equipped with basic resources and orientation materials, Kyle turns his attention to academic preparation, beginning with a visit to the university library. At the entrance, he interacts with a NeuroBi screen, scans his QR code, and receives updates on available study rooms, quiet zones, and upcoming library events. Based on his academic profile which is linked to his registered courses now NeuroBi



Fig. 8. Use Case Scenario of a new student going to their student office

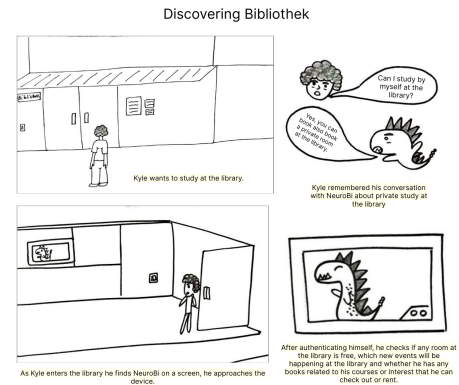


Fig. 9. Use Case Scenario of a new student going to their university library

suggests relevant readings and recently added books related to his study program. The system also alerts him about borrowed material deadlines and allows him to print floor maps or booking confirmations if needed. These features help Kyle orient himself academically and establish early study routines with greater confidence.

## 7.6 Sports Course Registration – University Sports Center

With his study goals mapped out, Kyle continues exploring extracurricular opportunities by visiting the University Sports Center. Kyle is eager to explore all the university sports courses. NeuroBi greets him upon entry to the Sports Center and presents registration deadlines, course suggestions based on his schedule, and even prompts about teaching assistant opportunities for advanced students. It simplifies the otherwise bureaucratic payment and confirmation process, showing NeuroBi's role in facilitating administrative efficiency.

## 7.7 Language Course Selection – University Language Center

Before ending the day, Kyle makes a final stop at the University Language Center to register for German courses and gather information on DAAD-funded learning opportunities. NeuroBi suggests courses aligned with his degree, alerts him about placement tests, registration windows, and DAAD funding deadlines. Through the app, Kyle uses AR directions to find his assigned classroom. NeuroBi even previews upcoming language events and conversation clubs, integrating academic and cultural learning.

## 8 DISCUSSION

The development of NeuroBi has been shaped by personal experience, speculative prototyping, and design-centered ideation rather than technical implementation. As a result, its strength lies not in functioning code or product readiness but in the articulation of a plausible, user-centered system architecture rooted in the values of calm, inclusive, and situated interaction.

This conceptual journey has highlighted several key tensions:

- (1) **Tangible vs. Invisible Interfaces:** NeuroBi blends visible kiosks with wearable and digital augmentation. While the kiosks serve as clear interaction points, the ear stick-ons and mobile app recede into the background. Balancing these modalities raises questions about user control, privacy, and cultural appropriateness — especially in shared public spaces.
- (2) **Personalization vs. Data Sensitivity:** The system promises helpful nudges based on a student's academic timeline and campus activity. However, as with any IoT-based infrastructure, this personalization depends on data collection. The design must therefore anticipate concerns about surveillance, opt-in mechanisms, and transparent data use — themes echoed in smart city critiques [6][8].
- (3) **Institutional Fit vs. Research Vision:** NeuroBi is envisioned as a scalable network, but real-world deployment would depend on collaboration with IT departments, administrative staff, and student services. While this paper offers a high-level

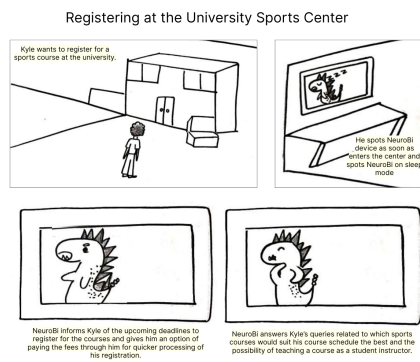


Fig. 10. Use Case Scenario of a new student going to their university sports center

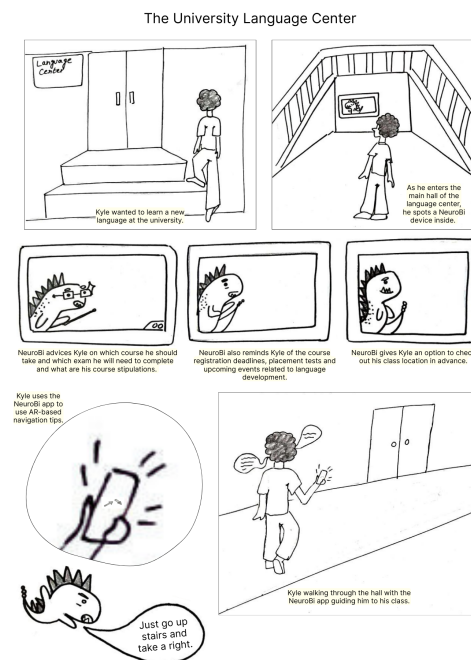


Fig. 11. Use Case Scenario of a new student going to their university language center center

sketch of feasibility (e.g., through APIs, cloud sync, disposable hardware), much remains to be explored in co-design workshops and prototyping sessions.

- (4) From Autoethnography to Generalization: The scenarios presented were grounded in the author's personal onboarding experience. While this method brings authenticity and depth, its generalizability is inherently limited. Future iterations should incorporate diverse student voices, including those from different programs, linguistic backgrounds, and accessibility needs.

In short, the design of NeuroBi is not "complete" but intentionally open-ended — a provocation for how tangible computing can support transitional moments in academic life without overwhelming or infantilizing its users.

## 9 CONCLUSION

NeuroBi emerged from a deceptively simple question: What would it feel like to be truly supported as a newcomer in an unfamiliar campus environment? From this starting point, the project evolved into a layered vision for a calm, context-aware assistant that gently supplements, but never replaces, human interaction. Using Bauhaus-Universität Weimar as a case study, this report explores how distributed, tangible devices and low-friction interactions could ease onboarding for international students. Through kiosks, wearable

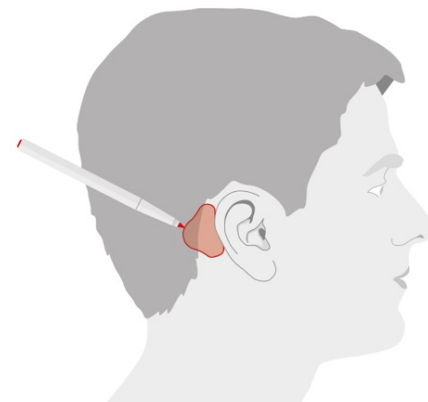


Fig. 12. Picture showing the optimal position to apply bone conduction ear wear [17]

audio interfaces, and AR-based mobile guidance, NeuroBi offers a cohesive and empathic support system embedded into the geography of university life.

The design also serves as a critique of how universities (often unintentionally) shift the burden of orientation onto students. Rather than waiting for students to learn to "figure it out," NeuroBi suggests that support systems can be proactive, ambient, and humble in

their presence, a vision drawn from the traditions of ubiquitous computing and human-centered AI.

While the project is still conceptual, it opens new directions for future research in calm interaction, contextual AI, and inclusive onboarding design. It also invites the institution to see its infrastructure not only as a set of services, but as a relational experience, one that begins the moment a student arrives and continues through each quiet, confusing, or hopeful step they take.

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## DECLARATION OF AUTHENTICITY

I hereby declare that the work presented in this report is entirely my own and that any external sources have been appropriately cited. This submission complies with the academic integrity guidelines of Bauhaus-Universität Weimar. I understand that violations of academic integrity may result in disciplinary action.

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