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# MANAGEMENT

# Improving the Travel Experience of Tourists with Physical Disabilities Through Smart Technologies and Ergonomic Assistive Devices

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**Abstract.** This article examines how smart technologies and ergonomic assistive devices can improve the travel experience of tourists with physical disabilities. It treats accessibility as the reliable completion of a journey rather than the presence of isolated features. A structured integrative review of twelve peer-reviewed studies published from 2023 to 2026 was undertaken across accessible tourism, human-computer interaction, rehabilitation technology and ergonomics. The evidence indicates that verified accessibility information, personalized route planning, geospatial guidance, adaptive mobility controls, pressure-management systems and accessible digital interfaces can strengthen autonomy, safety and comfort. Their value, however, depends on person-environment fit, co-design, staff readiness, maintenance, privacy and a non-digital fallback. The article proposes a travel-stage matrix and a smart-ergonomic experience cycle for evaluating solutions from pre-trip planning to post-trip improvement. The framework shifts attention from technology ownership to task performance, user effort, dignity and participation. It also identifies practical indicators for tourism providers and destinations without claiming causal effects that have not been field-tested.

**Keywords***: accessible tourism; physical disability; smart technology; ergonomics; assistive devices; wheelchair mobility; user experience.*

## 1. Introduction

A tourist journey is a chain of physical and digital tasks: booking, reaching a terminal, boarding, transferring, navigating, using accommodation and attractions, and responding to disruption. For a traveler with a mobility limitation, failure at one link may invalidate every earlier arrangement. Accessible tourism is therefore a continuity problem that joins the built environment, information, technology, service and social interaction [1-3].

Physical disability is not a single functional profile. Travelers may use wheelchairs, scooters, prostheses, walkers or crutches and differ in reach, grip, balance, endurance, pain and equipment. Qiao et al. show that wheelchair travel is embodied and multisensory, while Tao et al. identify distinct barrier-based segments among tourists with physical disabilities [1, 2]. Solutions must therefore be adjustable rather than standardized around an assumed user.

## 2. Conceptual framework

### 2.1. Travel-chain continuity and user agency

Continuity requires truthful information. A generic accessible label cannot support decisions about gradient, surface, thresholds, lift dimensions, transfer space, bed height, charging or transport. Records should state what was checked, when it was checked and what remains unknown. Testing of the access@tour platform showed why accessibility and usability must be evaluated together and with end users [4].

### 2.2. Ergonomic fit as a travel-quality mechanism

Ergonomics explains how design changes physical and cognitive demand during a real travel task. Assessment should examine force, reach, posture, maneuvering space, transfer, vibration, pressure, mental workload and assistance. Wheelchair studies show that technical performance depends on user, environment and organization, and that control design or developer judgment may not match user experience [9, 11, 12]. Co-design and scenario testing are therefore essential.

## 3. Materials and methods

The article uses a structured integrative review and design synthesis. Twelve peer-reviewed works published in 2023-2026 were selected from accessible tourism, human-computer interaction, rehabilitation technology and ergonomics. Evidence was coded by travel stage, barrier, technological function, ergonomic mechanism, reported outcome and limitation. The unit of analysis was the travel task rather than the device.

No original survey, experiment or platform analytics were conducted. The matrix and cycle are analytical products, not validated scales; they require participatory field testing before use in certification or investment ranking.

## 4. Smart technologies across the travel journey

### 4.1. Pre-trip information and personalization

Pre-trip systems should match verified access attributes to a voluntary functional profile that includes device dimensions, transfer method, reach, grip, endurance, charging and assistance preferences. Recommendations must explain why an option fits, what is unknown and what fallback exists. AI may support autonomy and well-being, but adoption depends on usefulness, effort and facilitating conditions, and an algorithm cannot verify physical access without current facility data [5, 6].

**4.2. Accessible routing and real-time support**

Shortest-path navigation commonly ignores curb cuts, gradient, surface, crossing time, lift status and temporary obstruction. Accessible routing should balance distance, effort, exposure and risk for the individual profile. Geospatial research for wheelchair users supports connecting pedestrian and public-transport segments instead of treating mobility as a single route [8].

Real-time alerts can manage disruption, but stale data, lost connectivity and depleted batteries create risk. Critical guidance needs timestamps, confidence indicators, offline information, accessible help and a safe manual alternative. Location data should be opt-in and limited to the selected purpose.

**4.3. Smart wheelchairs, seating and transfers**

Smart wheelchairs can add obstacle detection, speed adaptation, alternative control and emergency communication. These functions should preserve predictable control and be tested on thresholds, ramps, lifts, tight turns and transport boarding. Training, charging and maintenance are part of performance, not after-sales details [9].

Connected seating can monitor posture, pressure and weight shifts during long journeys. In a study of forty-three wheelchair users, two systems produced different usability patterns and needs across subgroups [10]. Alert frequency, hardware handling, calibration and charging must fit motor and sensory capacity; no single configuration is appropriate for every traveler.

**4.4. Accommodation, attractions and public space**

Public space determines whether accessible facilities form a usable network. Research in Macao links wheelchair users' participation to the interaction of physical and social street features [7]. Destination systems should therefore connect routes, crossings, rest points, accessible toilets, charging, repair and disruption reporting instead of mapping isolated venues.

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**5. Integrated evaluation model**

Evaluation should combine information reliability, technological usability, ergonomic task performance and experience outcome. Reliability asks whether promised access matches observed conditions; usability asks whether the traveler can learn, operate and recover from error; ergonomic performance covers effort, posture, control and transfer; outcomes cover autonomy, safety, comfort, dignity and participation. A serious failure in one dimension should not be hidden by an average score.

*Table 1*

**Smart and ergonomic responses across the accessible travel chain**

| Travel stage | Smart solution | Ergonomic requirement | Core indicator |
|---|---|---|---|
| Search and booking | Verified access database; profile-based filtering | Low-effort input; clear language; accessible authentication | Match between promised and observed access |
| Transport | Disruption alerts; accessible boarding confirmation | Safe approach, securement, transfer and recovery | Independent or preferred-assistance completion |
| Outdoor route | Personalized geospatial navigation; obstacle updates | Gradient, surface, curb, crossing time and rest | Effort, delay and route deviation |
| Lodging | Digital key; equipment reservation; room controls | Reach, maneuvering and transfer-space fit | Task success without unsafe compensation |
| Attraction | Indoor guidance; timed entry; accessible content | Queue, seating, door force and control access | Participation in the intended experience |
| Post-trip | Accessible feedback; incident and maintenance log | Low-burden reporting with user control | Resolution time and verified improvement |

Indicators should be tested through realistic scenarios from booking to emergency exit. Observers can record completion, time, assistance, errors, exertion and discomfort, while participants report whether the result felt autonomous and dignified.

Figure 1 presents a continuous cycle: profile needs with consent, verify conditions, plan with fallback, assist in real time and use outcomes for maintenance and redesign.

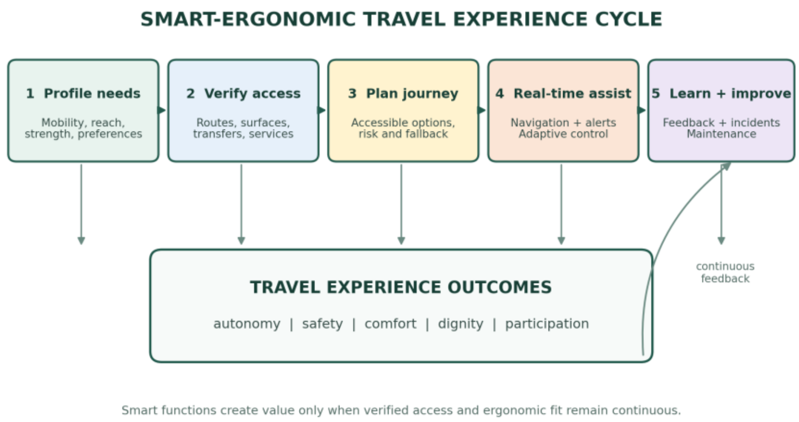


Figure 1
**Smart-ergonomic travel experience cycle (developed by the authors)**

## 6. Implementation priorities

Implementation should begin with high-consequence gaps: emergency egress, essential routes, transfers, sanitation and transport interfaces. Providers then need an owned, dated accessibility dataset. Technology should be procured for a defined task and tested with different mobility devices, first use, low connectivity, incorrect data and recovery from error [4, 12].

Operational readiness requires staff training, equipment checks, escalation rules and privacy safeguards. Records should identify who confirms equipment, clears routes, responds to outages and corrects information. Essential access must remain available without a recent smartphone, an app or location tracking.

## 7. Discussion

Recent research converges on a simple principle: technology improves tourism when it strengthens real agency. AI, sensors and automated controls can reduce uncertainty and effort, but can also create false confidence or dependence. A robust model combines verified infrastructure, ergonomic equipment, accessible interfaces, trained people and a non-digital fallback selected by the traveler.

This interpretation changes investment logic. Counting apps, ramps or devices rewards inputs; measuring task completion reveals whether the journey works. A destination may have many accessible venues but fail because routes between them are broken. Conversely, a modest tool that reliably confirms a route or transfer device can preserve energy, confidence and choice [1-3, 7].

## 8. Limitations

The review is integrative rather than a registered systematic review, and the sources differ in population, method and setting. Emerging AI and implantable technologies have less mature evidence than established accessibility interventions. The indicators remain unweighted and cannot replace local standards, clinical assessment or participation by people with disabilities.

## 9. Conclusion

Improving travel for tourists with physical disabilities requires accurate information, continuous routes, ergonomic mobility and transfer support, usable interfaces, trained service and reliable recovery from failure. Results should be judged through autonomy, safety, comfort, dignity and participation.

The proposed matrix and cycle begin with user needs, verify the environment, select technology for a defined task and use outcomes to improve the next journey. Technology is thus an accountable means of conserving effort, supporting choice and enabling equitable participation.

## References:

**[1]** Qiao G, Hou S, Chen Q, Xiang G, Prideaux B. Role of body in travel: wheelchair users' experience from a multi-sensory perspective. Journal of Travel Research. 2025;64(6):1414-1430. https://doi.org/10.1177/00472875241249391

**[2]** Tao C, Huang S, Wang J, Qiao G. Accessible tourism: tourists with physical disability - segmentation based on perceived travel barriers. Tourism Review. 2025;80(9):1654-1676. https://doi.org/10.1108/TR-07-2023-0459

**[3]** Nigg JJ, Plaikner A, Peters M, Haid M. Leisure constraints towards accessible tourism: self-characteristics of people with disability along tourism value chains. Current Issues in Tourism. 2025;28(18):3031-3045. https://doi.org/10.1080/13683500.2024.2394965

**[4]** Teixeira P, Teixeira L, Eusébio C. Evaluating both usability and accessibility: the case of access@tour by action - a digital solution for accessible tourism. Disability and Rehabilitation: Assistive Technology. 2025;20(4):1159-1175. https://doi.org/10.1080/17483107.2024.2409810

**[5]** Marino-Romero JA, Robina-Ramírez R, Pavón-Pérez JA, Roets AOSB. Enhancing happiness and well-being: AI-driven solutions for accessible, inclusive travel experiences for people with disabilities. Disability and Rehabilitation: Assistive Technology. 2025;20(7):2173-2184. https://doi.org/10.1080/17483107.2025.2488391

**[6]** Ali L, Kiliç H, Öztüren A, Ali F, Jiayuan C. Tech-enabled travel: harnessing innovation diffusion and UTAUT to empower mobility-impaired tourists. International Journal of Human-Computer Interaction. 2026;42(10):7546-7566. https://doi.org/10.1080/10447318.2025.2560515

**[7]** Wan YKP, Sou PJ, Kong WH. Spatial justice and street accessibility for wheelchair users in Macao. Tourism Geographies. 2025;27(7):1424-1444. https://doi.org/10.1080/14616688.2024.2443888

**[8]** Mostafavi MA, Bahloul M, Boucher N, Routhier F. A novel geospatial assistive navigation technology for seamless multimodal mobility of wheelchair users.

Studies in Health Technology and Informatics. 2023. https://doi.org/10.3233/SHTI230652
**[9]** Fishleigh L, Taylor R, Hale G, Bowers DS. Factors that affect powered wheelchair use for an adult population: a systematic review. Disability and Rehabilitation: Assistive Technology. 2024;19(7):2651-2664. https://doi.org/10.1080/17483107.2024.2304122
**[10]** Jordan KS, Vos-Draper T, Morrow M, Sonenblum S. The usability of two mobile health assistive technologies for wheelchair-related in-seat movement and pressure. Journal of Rehabilitation and Assistive Technologies Engineering. 2023;10:20556683231211808. https://doi.org/10.1177/20556683231211808
**[11]** Koyama S, Tatemoto T, Kumazawa N, Tanabe S, Nakagawa Y, Otaka Y. The effect of differences in powered wheelchair joystick shape on subjective and objective operability. Applied Ergonomics. 2023;107:103920. https://doi.org/10.1016/j.apergo.2022.103920
**[12]** Borges LR, Abreu Rosa de Sá A, Naves ELM. A heuristic-based approach for assessing usability in electric powered wheelchairs: a preliminary investigation. Rehabilitación. 2024;58(2):100831. https://doi.org/10.1016/j.rh.2023.100831