Gesture-A11Y: A Large-Scale Hub for Accessible Gesture Input

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Abstract

We introduce Gesture-A11Y, a large-scale, web-based hub serving as a searchable database and tool to assist researchers and practitioners in identifying gestures that align with the abilities and preferences of users experiencing visual or motor disabilities. Gesture-A11Y is the result of an eight-year-long research effort, during which we collected over 22,000 records of *touch, motion, on-wheelchair,* and *on-body gestures* performed by users with various abilities, along with their preferences of gesture input across various devices and contexts of use. We offer Gesture-A11Y as an open-source tool to drive more accessible and inclusive gesture interaction design.

CCS Concepts

• **Human-centered computing → Gestural input**; **Systems and tools for interaction design**; **Accessibility systems and tools**.

Keywords

Web-based tool, accessibility, gesture input, gesture set design

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1 Introduction

Designing efficient gesture interactions requires a solid understanding of users' input performance and preferences. Unfortunately, open data on users with impairments remains difficult to find, despite the growing reliance on gesture input in mobile and wearable devices. To address this, we introduce Gesture-A11Y, a web-based hub featuring over 22,000 gesture records from users with visual or motor impairments. Gesture-A11Y is the only tool of its kind, offering unprecedented access to resources for empowering more accessible gesture input design.

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2 Roadmap and Implementation

Gesture-A11Y is the result of an eight-year-long research effort aimed at making gesture-based interaction more accessible for users with diverse abilities; see Figure 1 for our four-stage roadmap.

In *Stage #1,* we examined accessibility challenges in gesture input. Several systematic reviews [4,9,10] confirmed a critical gap, where open gesture datasets addressing users with impairments were lacking. In *Stage #2,* we conducted gesture collection studies [1,13,16,17] involving users with various abilities and health conditions (e.g., Spinal Cord Injury, Multiple Sclerosis, Cerebral Palsy, Parkinson's, and Traumatic Brain Injury). In *Stage #3,* we assessed user performance (e.g., production time and accuracy [16]), user experience (e.g., perceived social acceptability of gesture input [14]), and preferences (e.g., user-defined gestures [1]) across a range of gesture types and devices. Our efforts culminated in *Stage #4* with the development of Gesture-A11Y, the first-ever tool offering an extensive collection of readily available gestures that reflect the preferences and abilities of users with impairments.

This roadmap led to an unprecedented body of knowledge on gesture input (see Table 1), covering the key elements of the context of use [2]—*users, platforms,* and *environments*—which we are now sharing with the community to support inclusive design practices:

- *Diverse gesture types.* Gesture-A11Y provides access to records of touch, motion, on-body, and on-wheelchair gestures.
- *Wide device coverage.* We targeted prevalent mobile devices [15,16] but also wearables—watches, glasses, rings [17]—which are expected to gain further popularity in the foreseeable future. Gesture-A11Y also supports novel interaction paradigms, such as on-body [1] and wheelchair-based [3] input.
- *Representative environments.* Gesture input and preferences were collected in both private [1,13] and public [16] settings.
- We adopted *open-source technologies* to ensure broad access to Gesture-A11Y from virtually any platform or device with a web browser. The frontend was built using Vue.js, backend operations were handled with Golang, and tabular data was processed using the Pandas Python library. To facilitate effective identification of resources in our extensive database, we implemented search filters based on keyword, gesture

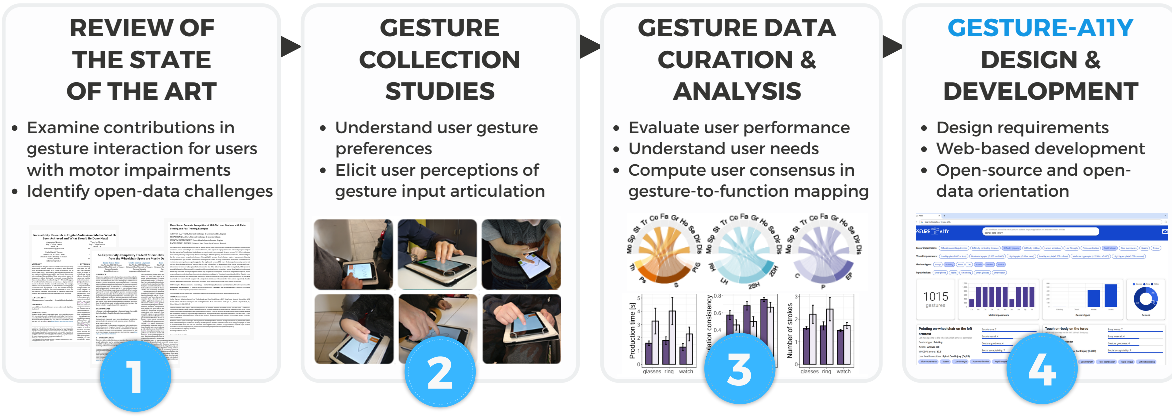

Figure 1: Our four-step methodology and roadmap for Gesture-A11Y.

Table 1: Gesture records indexed in Gesture-A11Y, readily available through the searchable user interface.

Gesture type: Touch strokes	Gesture type: Motion	Gesture type: On-body	Gesture type: On-wheel chair	Num. of records	Num. of users	Type of imp.§	Data type (numerical, textual, computational)	Description (context, device, procedure, involved body parts)	Example of representative records	Reference
–	✓	✓	✓	231	11	MI	textual descriptions with manually extracted attributes†	use-defined hand gestures for remote control	on-body tap on the left thigh to access e-books	[1]
–	✓	✓	✓	924	11	MI	numerical/ordinal self-reported ratings‡	perceived ease of execution, recall, goodness of fit, social acceptability	social acceptability was rated 6.42/7 on average	[1]
✓	–	–	–	4,662	35	MI	numerical (x, y) screen coordinates with timestamps	touchscreen stroke gestures performed on mobile devices	directional swipes, letters, and symbols (e.g., heart)	[16]
✓	–	–	–	7,290	14	MI	numerical (x, y) screen coordinates with timestamps	touchscreen stroke gestures on smartwatches, glasses, rings	directional swipes, letters, and symbols (e.g., asterisk)	[17]
✓	–	–	–	3,313	27	VI	numerical (x, y) screen coordinates with timestamps	touchscreen stroke gestures on mobile devices	letters and symbols (e.g., question mark)	[15]
–	✓	–	–	3,809	14	MI	numerical (x, y, z) accelerations with timestamps	mid-air motion gestures of the finger, wrist, and head	index finger mid-air tap, wrist shake, head rotate	[17]
✓	✓	–	–	2,625	21	MI	numerical/ordinal self-reported ratings‡	perceived social acceptability, ease of use, desirability, comfort, fun	watch gestures are preferred by SCI users	[14]
				Total 22,854						

†Attributes: gesture complexity, localization in the gesture space relative to the user's body, handedness, gesture-to-function mappings.
‡Ratings elicited using 7-point Likert scales. §VI – visual impairments, MI – motor impairments; details about impairments in column "Ref."

type, impairment, and device type, e.g., practitioners can search for "stroke gestures" performed on "smart watches" by users with both "tremor" and "difficulty holding objects."

- *Open data.* Gesture-A11Y is available under an open-source license to ensure unrestricted access to its resources and foster democratization of accessible gesture interaction design. We also envision it as a living hub with evolving resources.

3 Gesture Input Design with Gesture-A11Y

We conclude by highlighting several ways in which Gesture-A11Y can drive accessible gesture input design. First, practitioners can readily identify gesture sets aligned with specific impairments, such as spasm or tremor [5], used as indexes in our database. Second, researchers can conduct comparative analyses, spanning diverse gesture and device types, e.g., to explore consensus on mid-air input [6] across specific system functions. Third, AI models can be trained on our large dataset for generative interaction design [11] in accessibility. Lastly, by democratizing access to open resources, Gesture-A11Y empowers emerging Do-It-Yourself practices [13] with opportunities for highly personalized interactions [7].

4 Gesture-A11Y and Accessible Employment

In the context of promoting inclusive and sustainable economic growth and full, productive employment,[1] Gesture-A11Y can play a significant role in making mobile devices more accessible to all users. Since the vast majority of interactions with mobile devices implicitly rely on gesture input, gesture accessibility is a key factor in overall mobile interaction accessibility. Enhancing it can contribute to more inclusive employment [8] by facilitating universal access to digital resources and services via mobile devices [12]. We look forward to these advancements, made possible by unprecedented access to open resources for more accessible gesture input design.

[1]The theme of the W4A '25 conference, https://www.w4a.info/2025.

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