

Assistive Technology in the Polling Place: Current and emerging technology

A white paper for the
EAC-NIST Human Factors Public Working Group

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Whitney Quesenbery, Center for Civic Design
Jennifer Sutton, JSutton Media

This white paper reviews the types of personal assistive technology (AT) that voters might use in the polling place.

It focuses on technologies that are either currently in common use, or being developed through research that may result in products or services likely to be widely available within the next 5-10 years.

It's aim is input into the process of writing voting system standards or other guidance for election administration.

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Current VVSG requirements for assistive technology

VVSG 1.1 says that the voting system must not require voters to bring any special technology to the polling place in most cases. The discussion says that it does not “eliminate the need for a voter’s ordinary non-interacting devices, such as eyeglasses or canes.” It also requires that systems not interfere with the use of common assistive technology (AT) such as hearing aids or mobility aids, and allows for some types of AT to be connected using an industry standard jack.

The full text of the requirements for assistive technology is at the end of this paper.

- 3.3.1 General accessibility. Requires that personal assistive devices are not required to operate the voting system
- 3.3.3 Audio-tactile interfaces required
- 3.3.4 Enhanced input and control characteristics. Requires a 3.5 mm industry standard jack
- 3.3.5: Design for mobility aids. Requirements are based on the ADAAG
- 3.3.6 Enhanced auditory interfaces. Requires no electromagnetic interference with assistive hearing devices
- 3.3.9 Speech not required to operate the voting system

Why guidance for assistive technology might need updating

The requirements in VVSG 1.1 were drafted in 2007 (although the final version was not adopted until 2015). This work, then, was largely undertaken before widespread availability of mobile devices, such as smartphones and tablets¹, which have been part of both a rapid increase in the availability of assistive technologies and and (in some cases) a sharp decrease in the cost.

The extraordinary expansion in technology generally, coupled with the specific availability of mobile devices have both changed the landscape in several ways:

- New technologies are available that might be incorporated into voting systems.
- Voters themselves might routinely use new devices and functional features both externally, as supporting technologies, and/or with the expectation that they will be able to use them to interact with some parts of a voting system.
- Many of these “assistive” technologies are available to any voter on mainstream consumer devices.
- Personal assistive technologies can fill gaps in the accessibility features, making voting systems more universal.

¹ The Apple iPhone was first released in 200X

Understanding which assistive technologies are already in use and what new ideas are actively being explored has implications beyond accessible voting for people with disabilities. Researchers often investigate how new technologies can be used in extreme conditions as a way of pushing the boundaries of knowledge. Those same technologies first used for people with disabilities then often make their way into mainstream use. This is the opposite of much commercial development, which tends to start with the broadest, easiest use case, and then expand to additional audiences.

This paper does not include a review of the number of people with disabilities who might use the technologies discussed here. A related paper, *Use of Personal Assistive Technologies in Voting*², already covers the prevalence of disabilities and the cost of personal assistive technologies.

Like other standards, requirements for voting systems need to be robust to assure they remain useful over many years. Looking at emerging technology can help us predict which technologies might become so common that they are an expected part of everyday life, much as the idea that anyone can have a camera, phone, and GPS in their pocket.

How this white paper is organized

One of the challenges of developing this white paper was deciding how to organize the information. There has not been consensus on the best approach. Past work has included information structured by disability, functionality, and system characteristics. The proposed structure for the requirements on human factors and privacy being used by the [NIST-EAC Public Working Groups](#) is organized by the POUR Principles (perceivable, operable, understandable, and robust) from the [Web Content Accessibility Guidelines](#) (WCAG 2.0).

The problem is that almost any structure leads to having requirements repeated in different sections.

We started this work by thinking about the voter journey, that is, all the steps a voter takes in voting at a polling place. We identified the following major steps:

- Finding their way from the polling place from street to entrance
- Navigating within the polling place
- Identifying themselves at the registration desk
- Receiving a ballot or authorization to vote
- Marking their ballot
- Verifying and casting their ballot

² Jackson, J.E., Pierce, G.L., Blosser, S.R. et al (2015). [Use of Personal Assistive Technologies in Voting: Final report for NIST Cooperative Agreement 60NANB14D265.](#)

The VVSG is concerned with voting systems, a subset of election systems and the entire voter experience. However, voters may arrive at a polling place with assistive technology in hand, and there are interactions between voting systems and other systems used in the polling place, so we considered the entire experience from arriving and entering, to leaving.

Of course, there are wide variations in how these steps are performed, depending on local election law and customs, and the voting systems in use. However, from the perspective of a voter, each of these activities is a hurdle to be negotiated.

Within each step of the journey, we discuss possible barriers, who might be affected by the barrier, and technologies that might remove or reduce the barrier through either personal AT or features built into the election system. Where a technology might be used in more than one place, we have included it in the step where it seems most critical.

We have not addressed the physical location—the built environment—of the polling place. Those issues are well covered elsewhere:

- The ADA and the [ADA Architectural Guidelines](#) (ADAAG) cover the physical space requirements and reach-and-touch guidelines for equipment. (These requirements are included in the VVSG in Section 3.3.5: Design for Mobility Aids.)
- The Department of Justice [ADA Checklist for Polling Places](#) includes ways to ensure that the physical path to the polling place, and navigation within it, meet accessibility guidelines for clearance, ramps, and obstructions.
- There are many advocacy and self-advocacy projects focused on the polling place. The projects by local groups within the [National Disability Rights Network](#) are a good example. They include polling place accessibility surveys of voters, checklists to help local election officials provide more accessible polling places, and a project that engages officials and advocates to better understand the accessibility issues.

We did not include important final steps, such as reading results or checking voting status online because these activities typically take place outside of the polling place, where voters' personal technologies are used in their own technology setup. These interactions are covered by the ADA and Section 508 or equivalent state requirements. Since 2010, the Department of Justice has relied on the public Web Content Accessibility Guidelines (WCAG 2.0) in disability rights litigation³.

³ NEED REFERENCE

New technologies that might be used at the polling place

The broad goal for the use of technologies (or non-technological assistive devices or procedures) is to ensure that voters are able to use the communication and interaction methods that are most familiar to them.

We looked for emerging technologies that either are already in common use, or might be generally available in the next 5-10 years.

One of the challenges in deciding which new technologies might become useful in elections is that they often require wide adoption for enough people to both know how to use them and expect them to be available. QR codes provide a good example of the challenge. These codes are widely used in Asia as a way of communicating web links. They could be useful in providing links to all sorts of election information (and help solve the challenge of long links that are hard to type). Unfortunately, this use is not common in the United States. On the other hand, they are widely used on tickets and boarding passes, suggesting that they can be helpful as a specialized technology if incorporated appropriately into elections.

This is not an exhaustive survey of available technologies, products, or research projects. Instead, we have attempted to show the range and type of assistive technology entering the mainstream and how it might be helpful in elections.

Finding their way to the polling place from street to polling place

The goal of any technology in this stage of the voter journey is to allow people with disabilities the same degree of independence as any other voter. If a polling place is staffed with people to provide directions for everyone, that works for voters with disabilities as well.

Signage

Signs are a low-tech and important part of wayfinding. As a reminder:

- All signs should meet general regulations for typography (font size, contrast), location, and height to make signs easy to read. Signs should be placed so that they are easily visible from all directions.
- All turns or directions from the street to the polling place need similar signage.
- Braille is required for door signs, elevators, and other navigation inside a building.

Smartphone wayfinding apps

Many smartphone apps and GPS services support general wayfinding that voters can use to find the polling place. Newer apps include information about features of the landscape that are helpful to everyone. Wayfinding apps can be used for real-time navigation or to simulate a location to plan a route in advance.

A wide variety of wayfinding apps offer users many choices among interaction styles and features.

- General navigation apps include Apple and Google maps, [WAZE](#) and other GPS navigation.
- Location-finding apps such as [FourSquare](#) and [Yelp](#) also provide links and directions to places that can include polling places.
- Election websites that offer a way to look up polling places can also provide addresses in a way that works seamlessly with map and wayfinding apps.

There are also apps created as assistive technology such as [Blindsquare from MIPsoft](#), [Nearby Explorer](#) from the American Printing House for the Blind, and the [RNIB Navigator](#) from the Sendero Group. These apps add features for non-visual use, like periodic announcements about the surrounding location and progress towards a destination, and the use of headset controls and gestures in addition to on-screen controls. They also feature displays to assist those with low vision, including large text and high contrast options.

The challenges for these apps is not only having the mapping and navigation itself, but also having the data about the local area, and having mapping data down to the granular level needed for non-visual navigation. Although beyond the scope of the VVSG, the need for this data suggests an opportunity to make it easier for people who rely on wayfinding apps by making sure that detailed data about polling places is available.

Wayfinding beacons

Although these are not yet commonly deployed, several research projects explore the use of beacons to indicate particular locations, such as the door to the polling place building, a specific room, or the voting machine. These systems work by providing a communication signal that a wayfinding app can use as a homing beacon, guiding the user to the location. To provide the best results, a network of beacons is ideal since such a network makes it possible to receive detailed directions, rather than simply identifying a specific landmark.

Early projects have focused on campuses or building complexes that are not mapped well by the commercial GPS services. Accessibility features may include announcing landmarks, directions to accessible ramps and elevators, or warning of obstacles ahead.

As with other navigation systems, for beacon navigation to become widespread, a reliable and extensive dataset is required, and standards for communicating the data through an app or other device must be in place.

Some examples of these projects and explanations of how beacons are used include:

- [NavCog](#) an open platform from IBM Research and Carnegie Mellon University
- [Wayfindr](#), an open standard for navigation
- [7 Reasons to Use Beacon Technology on Campuses](#) lists several active projects
- [4 ideas from 4 continents: helping the blind navigate cities](#) lists examples of urban navigation apps

Wearables with wayfinding

Wearables including the [AppleWatch](#), personal monitors such as [Fitbit](#), [Polar SportsWatch](#), and other sports bands and accompanying apps can also support wayfinding in several ways. They all use the wearable for communication with the user, relying on a smartphone for GPS, web connections, and other data.

The communication is non-visual; for example, the device might vibrate or make a sound to indicate locations or help avoid obstacles.

Wearable video displays

Another form of wearable that might be used for both navigation to and around the polling place, or for interacting with the ballot are video goggles. The best known of these devices is the now-discontinued [GoogleGlass](#). Although Glass and other products such as Sony Glasstron failed in the marketplace, a new generation of gaming headsets are starting to appear on the market.

- [iWear Video Headphones](#) by Vuzix is designed to create an immersive experience for virtual reality games
- [AirScouter](#) by Brother is a small video display mounted on a headset

Paired with a small portable computer, these devices could work with conventional navigation aids or other computer-based assistive technology.

Navigation within the polling place

Within the building, general navigation tools are less useful because inside spaces are not as well mapped. There can also be problems with reception and GPS accuracy indoors. Communication with beacons, using technologies like Bluetooth, do not rely on satellite or cellular systems.

In addition, the polling place itself is typically set up for each election, so it would not be included in any general maps of a space. Even a vote center in a government building might have differences in the setup from election to election.

- Signage within the polling place is covered in the EAC Best Practice for Election Administration.
- Physical navigation is covered in the Department of Justice guidance on ADA compliance.

Computer and camera-based visual navigation systems

Some navigation systems use cameras, mounted on glasses or worn around the user's neck, to support navigation and relay information about the immediate environment. Instead of relying on a database of mapping details, they use image recognition.

- Toyota's [Project BLAID](#) uses cameras to detect stairs, doors, and other common features of indoor spaces, allowing navigation without beacons. It communicates through voice commands and haptic cues.
- Google's [Tango](#) adds 3D tools to support navigation, measurement, and other activities
- [Aira](#) is a visual interpreter for the blind that uses both computer and camera-based information, along with the possibility of human support, to describe the environment.
- [The BuzzClip](#) is a wearable mobility tool for the blind and people with low vision, focused on detecting obstacles using a proximity sensor with range detection. It was funded on IndieGoGo

There is also related research into assessing images and producing accurate alternative text. Although this ability is not directly related to navigation, it is an example of the kinds of research projects that are teaching computers to understand what they see through cameras.

- [Automatic Alternative Text](#) is a Wordpress plugin using Microsoft's computer vision API

Indoor beacons

The same sort of beacons discussed previously could be used within the polling place if they were easy enough to set up and communicated with popular apps. They also avoid the reception problems of systems that rely on external communications like GPS.

Challenges in using indoor beacons include cost, how easy they are to set up, and whether users will be familiar with them.

The iRobot Roomba Virtual Wall is an example of a commercial beacon system that is easy and flexible. These small beacons can be placed anywhere to guide the automatic vacuum cleaner from room to room or create a barrier. Although this system is for a specific product, it's easy to imagine how something similar could be used with other navigation apps.

Additional experiments with indoor location in public places include:

- [Indoo.rs](#) – an indoor navigation and proximity system is being tested at airports, including [San Francisco](#) and [Los Angeles](#)
- Wayfindr is also being used for [indoor navigation](#) via a Google Impact Challenge grant.
- Another form of beacons is found in products like [Tile](#), a small beacon that can be attached to any object, allowing it to be found by a tracker in a mobile device.

Identifying themselves at the registration desk

The polling place registration desk functions include both allowing the voter to identify themselves and any need to “sign in.” In this part of the process, there are many communication challenges for people who have disabilities related to hearing, vision, receptive or expressive language, and dexterity. The ability to use the communication methods these people generally use to interact in public is especially important here.

Hearing aids

At their simplest, there are some emerging systems that provide amplification and background muting, but they have typically raised questions about whether they are medical devices or personal technology. Their advantages in the polling place might include not relying on electromagnetic coils and being less susceptible to interference.

- The [BioAid project](#) developed a hearing aid algorithm that they make freely available.
- [Aud1](#), [Petralex](#) and [Ear Machine](#) are all examples of apps that use the mobile device's microphone and conventional earbuds with audio processing to enhance sound.

As these tools become more popular, they are likely to appear as an alternative to conventional hearing aids. Pollworkers might need training to understand that, although the voter may be wearing earbuds, this does not necessarily mean they are listening to music.

Speech to text systems

Dictation systems like the Dragon family of products from Nuance have long been in popular use as AT to help people type without the use of their hands, but they typically require training for an individual's voice.

New technologies make it easier for computers to understand speech, and that has led to applications and devices to help voters hear and understand what is being said to them. These technologies are making use of the built-in options mobile devices have, sometimes with cloud support for speech recognition.

The technical challenges for use as a way to support a conversation are the processing time needed for the conversion and the accuracy of the results. The latter is getting much better, especially for conversational speech, but may still have problems interpreting elections "terms of art." Some examples of speech-to-text projects include:

- Google's [Cloud Speech API](#) converts audio to text with support of machine learning, recognizing over 80 languages.
- Mobile applications like [Ava](#) transcribe speech, enable users to share the transcription through a chat-like interface, and claim to work in real time.

Sign language interpretation

Several research projects are working on being able to understand sign language and interpret it to speech or vice versa. The Deaf community has noted strongly that, like automatic captions, the results are not ready for general use, but these systems will most likely continue to improve.

- The [SignMe](#) project at a Philadelphia Hackathon used a number of commercial technologies and managed limited success in using signed words, but not finger-spelling.
- [MotionSavvy](#) is another competition project that is working on creating a consumer product.
- Apps like [ASL Translator](#) are based on [dictionaries](#) that might eventually be able to connect words into full interpretation.

Text-to-speech systems

Voters have to identify themselves to poll workers in order to sign in. In some jurisdictions, they are required to announce themselves so poll watchers can hear. This can be a challenge for many voters including those who cannot speak, who speak with a heavy accent, or who have a fear of speaking publicly.

There are many types of [Augmentative and Alternative Communication](#) (AAC) tools that are designed for people with speech disabilities. They use custom interfaces to collect input in the form of gestures, simple sign language, or symbol selection and convert them to speech.

- [Proloquo](#) is one of the popular AAC tools, now available as an iPad application
- GoTalk is a similar program for Macintosh OSX computers
- There is a variety of Android and iOS applications

More general text-to-speech programs are becoming more popular, often marketed as general apps rather than for people who have speech disabilities.

- In addition to screen readers built into iOS and Android, both operating systems include general systems like [Google Text-to-Speech](#).
- Other programs, like [iSpeech](#) and [ReadSpeaker](#), offer application interfaces to allow their functionality to be integrated into other tools.
- [SiteCues](#) from AISquared, the makers of ZoomText, includes speech output as part of a suite of tools that enhance website access. Of interest to elections, these controls sit on top of the web page, using existing accessibility features to allow users to set preferences.

Identification readers

Electronic poll books often include the ability to read an ID card to identify a voter. Although this may be an official ID, such as a driver's license or state-issued non-driver ID card, it can also be a bar code or QR code supplied by the election department.

Signature systems

Although not a digital technology, a simple signature guide may be an important AT to help voters sign a poll-book. This also suggests that building physical or haptic boundaries around the signature area on a digital screen is also useful.

Some electronic pollbooks use external signature pads, where the bezel creates a natural boundary.

Biometric ID systems

There is a lot of literature about the degradation of the signature as robust identification in the digital age.

Some organizations, such as Disney, rely on other biometrics such as a fingerprint or hand print. Other options include retina scans or vein patterns. All of them may pose accessibility challenges because not everyone has the capability to provide this data. One way to address this challenge is to be sure that voters are offered biometrics as one of several options. These systems may become widespread in the future.

Portable magnifiers

People who have low vision use both optical and electronic magnifiers to read labels and other information. A typical device will work in real time or capture the image,

enlarging the text to the desired magnification. Many of these devices are large and generally used in a single location. However, there are also many portable devices, often the size of a large smartphone, that could be used in a polling place.

Electronic magnifiers are often tailored to specific disabilities.

- AFB AccessWorld has a recent article on [types of electronic magnifiers](#) (this link is to the first part of a three part series of articles).
- Some of the key vendors include [Humanware](#), [VFO](#) (the merger of companies including Optelec and Freedom Scientific), [HIMS](#), and [EnhancedVision](#). All have a wide range of portable stand-alone magnification products to explore.

There are also a growing number of magnification applications that use the camera on a mobile device to enlarge information and make it easier to see. Just a few of the dozens on the iTunes store, many listed in their productivity or general utilities category. All of these apps are much less expensive than the stand-alone alternatives.

- [MagLight](#) – magnifying glass with light
- [Magnifier TiAU](#) – hand magnification with continuous zoom
- [See It](#) – video magnifier
- Apple has included a built-in magnifier in iOS10, making this technology even more mainstream.

Portable magnifiers are also used in marking, verifying, and casting a ballot.

Receiving a ballot or authorization to vote

There are many variations for what happens after someone is authorized to vote and when they are ready to mark a paper or electronic ballot. A few low-tech and digital tools to help with this process are mentioned here.

Activation cards with directional indicators

Activation cards can be manufactured with a notch or corner cut so that they are asymmetrical, helping voters orient them correctly.

Remembering preferences

Epollbooks in some states include an indication of whether a voter has requested assistance in the past.

Just as the [Global Public Inclusive Infrastructure](#) (GPII) proposes cloud-based storage of personal preferences, the voter registration database could store a limited number of settings/preferences, at the voter's discretion. An activation card or other means could be used to transfer that information to the voting system.

Transferring voting choices prepared at home

The [Los Angeles Voting Systems Assessment Project](#) (VSAP) proposes a unique solution to the challenge of quickly marking a long ballot by allowing voters to store their vote preferences in a QR code. Before beginning to mark their ballot, voters would have the option of scanning that code to transfer their voting choices to an electronic ballot marking system, reviewing those choices with the option to make further changes, before continuing to cast and print the ballot.

Marking their ballot

Marking the ballot brings us to the voting system and ways to support voters, either through external personal AT, whether connected or used in conjunction with the ballot marking activity.

Connecting personal AT

The VVSG already allows for personal AT to connect through a 3.5mm jack. Assistive technology that might use this option includes joysticks and other pointing devices customized for use with specific physical actions.

There are two challenges. The first challenge is that there is no standard communication protocol for these devices, limiting the devices that would work, and potentially disrupting the polling place with attempts to connect.

The second is that the 3.5mm jack limits the types of AT that can connect because the more common connections use a USB connector or Bluetooth, both of which are problematic for voting systems.

USB to 3.5mm adaptors are available from popular electronics stores and products designed to make some kinds of audio equipment connect to a MacBook.

Research ideas include:

- The [Tecla Shield](#) makes it possible to connect switches or wheelchair controls to other technology. This technology was used to add physical switches to an iPad in one of the ITIF-AVTI project: [Designing an Accessible iPad Voting Case](#).
- The Trace Center has long proposed a USB adaptor that is limited by its hardware design to emulating a keyboard at human speeds.
- The MSU paper, *The Use of Personal Assistive Technologies in Voting*, includes a detailed description of how intermediary technology or devices that manage translation between different connectors could be used to make it easier for a wider range of personal devices in the polling place.

Personal braille displays and note-takers

While there are no definitive statistics for how many people read braille, the ability to read braille in the polling place can be useful to those who rely on them. As with digital skills, even people who have learned braille have different degrees of competency. In addition, they may prefer braille for some tasks, but not others. For example, some people prefer it for long-form reading such as news articles, books, or ballot measure text, but not for interface tasks.

For those who do use braille regularly, personal braille displays or braille note-taker devices are becoming more affordable and available. Typically, braille displays connect via Bluetooth or USB, but it may be possible for them to connect to a voting machine using a 3.5 MM to USB adapter.

Braille displays are important for some blind users who prefer braille to audio, but critical for deaf-blind voters who rely on tactile input. Connecting them to a voting system is a challenge for several reasons:

- Lack of a standard “plug and play” connection protocol. They can be difficult to connect even to an open computer system without specialized drivers.
- It would be difficult to read the formatting of a typical ballot on a 20-cell display.
- The voting system might not be able to read input from the device.

Braille displays would more likely be used as a way to bring personal notes into the polling place. Poll workers would need to be able to recognize these devices and know that they are allowed.

Looking to the future, according to [District Dispatch](#), the National Library Service may eventually be authorized to distribute displays, making them more widely available.

Personal devices for literacy support

There is a type of personal assistive technology that supports people with some forms of reading disabilities, including dyslexia, attention disabilities, low literacy, or low English proficiency. They are most commonly used to support reading with features that adjust the presentation of the text, or provide dictionary support.

This software typically runs as an application on portable device such as a smartphone or tablet. They include products such as:

- Kurzweil 3000 and Firefly for Windows and Mac OS
- Voice Dream Reader for iOS
- NaturalReader for iOS and Android

Current products are unlikely to connect to a voting system, but they might be used in the polling place similarly to braille displays to support voters as they mark their ballot.

Portable magnifiers

Portable magnifiers are also important in identifying a voter at the registration desk (see above) and verifying and casting a ballot.

Verifying and casting their ballot

The final step in many voting systems is to check the ballot and verify that it is correct before casting it. When this is a paper ballot, this is a problem for voters with visual disabilities.

Portable magnifiers

Portable magnifiers are also important in identifying a voter at the registration desk (see above) and marking a ballot.

Optical character recognition

OCR technology can make it possible for voters to verify a computer-generated paper ballot. This requires the ballot to be formatted in a way that does not rely on an association of a graphical mark with a candidate name, sometimes called a “voter selections only” ballot.

- The [KNFB Reader](#) is a highly accurate OCR reader, designed to read common documents. It comes with a built-in voice and other features to support blind and low-vision users and is available for both iOS and Android platforms.

VVSG requirements for assistive technology (full text)

VVSG 1.1 says that the voting system must not require voters to bring any special technology to the polling place in most cases. The discussion says that it does not “eliminate the need for a voter’s ordinary non-interacting devices, such as eyeglasses or canes”

3.3.1 General Accessibility

c. The support provided to voters with disabilities **shall** be intrinsic to the Acc-VS. Personal assistive devices of the voter **shall** not be necessary to operate the Acc-VS correctly. This does not apply to personal assistive technology required to comply with 3.3.4b

3.3.3 Audio-tactile interfaces

i. The ATI shall provide its audio signal through an industry standard connector for private listening using a 3.5mm stereo headphone jack to allow voters to use their own audio assistive devices.

ii. If the ATI utilizes a telephone style handset or headphone to provide audio information, it **shall** provide a wireless T-Coil [ANSI01] American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19 9coupling for assistive hearing devices so as to provide access to that information for voters with partial hearing. That coupling **shall** achieve at least a category T4 rating as defined by [] American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19

3.3.4 Enhanced input and control characteristics

a. The Acc-VS **shall** provide a 3.5 mm industry standard jack used to connect a personal assistive technology switch to the Acc-VS. This jack **shall** allow only switch data to be transmitted to the voting system. The voting system **shall** accept switch input that is functionally equivalent to tactile input. All the functionality of the Acc-VS (e.g., straight party voting, write-in candidates) that is available through the conventional forms of input, such as tactile, **shall** also be available through this non-manual input mechanism.

3.3.5: Design for Mobility Aids

These requirements specify the features of the Acc-VS designed to assist voters who use mobility aids, including wheelchairs. Many of the requirements of this section are based on the ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).

a. The Acc-VS **shall** provide a clear floor space of 30 inches minimum by 48 inches minimum for a stationary mobility aid. The clear floor space **shall** be designed for a forward approach or a parallel approach.

b. When deployed according to the installation instructions provided by the manufacturer, the Acc-VS **shall** allow adequate room for an assistant to the voter. This includes clearance for entry to and exit from the area of the voting station.

Discussion: Disabled voters sometimes prefer to have an assistant help them vote. The setup of the Acc-VS should not preclude this.

c. Labels, displays, controls, keys, audio jacks, and any other part of the Acc-VS necessary for the voter to operate the voting system **shall** be legible and visible to a voter in a wheelchair with normal eyesight (no worse than 20/40, corrected) who is in an appropriate position and orientation with respect to the Acc-VS.

3.3.6 Enhanced auditory interfaces

c. No voting device shall cause electromagnetic interference with assistive hearing devices that would substantially degrade the performance of those devices. The voting device, measured as if it were a wireless device, shall achieve at least a category T4 rating as defined by [ANSI01] American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19

3.3.9 Speech not required

a. The voting system shall not require voter speech for its operation