



NIST Voting Technology Series
NIST VTS 100-3pt1

**Usability and Accessibility of
Electronic Pollbooks**

Part 1: Usability in the Polling Place

Whitney Quesenbery
Lynn Baumeister
Shanée Dawkins

This publication is available free of charge from:
<https://doi.org/10.6028/NIST.VTS.100-3pt1>

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Preface

This publication is reporting on research that was conducted in 2017. The use of e-pollbooks presented throughout the document reflects the state of elections in 2017.

Abstract

This report explores the use of electronic pollbooks (e-pollbooks) in elections. The scope of this report is on usability and accessibility of e-pollbooks, that is, their use by poll workers and voters, rather than on technical features or costs. This document reports on the use of e-pollbooks in the U.S.; their software, hardware, and interface design, usability, and evaluation. Also presented are the processes in which e-pollbooks are used and state laws encouraging or prohibiting their use.

Research described in this report was conducted in 2017. The use of e-pollbooks presented throughout the document reflects the state of elections in 2017. In the time since this research was performed, e-pollbooks have made progress addressing usability and accessibility issues. Additionally, as part of its ongoing Election Supporting Technology Evaluation Program (ESTEP) program, the Election Assistance Commission developed the Voluntary Electronic Poll Book Requirements (VEPBR) in collaboration with NIST. This publication is intended to provide a deep dive into how to evaluate the usability and accessibility of e-pollbooks in order to meet the relevant VEPBR user-centered design process and usability testing requirements as well as any state certifications pertaining to usability and accessibility.

Keywords

E-pollbooks; elections; electronic pollbooks; human factors; usability; voting

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Executive Summary

This report explores what makes electronic pollbooks (e-pollbooks) usable for election officials, poll workers, and voters. Many election officials today focus on the ability of the e-pollbook to be integrated into their elections processes and work seamlessly with their election systems. The usability of these systems is often not considered. Additionally, election officials don't have an effective means for evaluating the usability of an e-pollbook or a good understanding of what makes one e-pollbook more usable for poll workers, voters, and election administrators. The goal of the project was to understand current practice for designing the interface and interactions, and how e-pollbooks could be evaluated for usability.

During the project, information was sourced from demonstrations of e-pollbook systems, poll worker manuals and training materials from several jurisdictions, and reviews of reports from election officials about pilot studies or other projects that consider the use of e-pollbooks in their jurisdiction. In all of this fact-finding, the focus was on the usability of e-pollbooks, particularly for poll workers, as well as how election staff uses them before, during, and after Election Day.

Findings show that there is wide interest in using e-pollbooks to improve election administration, even though election laws do not always allow their use.

The perceived benefits of e-pollbooks include:

- Faster check in times on Election Day
- Better “customer service” such as helping voters find the correct polling place
- Increased accuracy of the voter roster
- Reduced time needed to update voter records in the central database after the election.

Concerns about e-pollbooks include:

- Introducing more technology into the polling place
- Acceptance by poll workers
- The cost of purchase and integration into election administration
- Security and election integrity issues of new technologies

The scope of this report is on usability and accessibility of e-pollbooks, that is, their use by poll workers and voters, rather than on technical features or costs. This document reports on the use of e-pollbooks in the U.S.; their software, hardware, and interface design, usability, and evaluation. Also presented are the processes in which e-pollbooks are used and state laws encouraging or prohibiting their use.

Research described in this report was conducted in 2017. The use of e-pollbooks presented throughout the document reflects the state of elections in 2017. In the time since this research was performed, e-pollbooks have made progress addressing usability and accessibility issues. Additionally, as part of its ongoing Election Supporting Technology Evaluation Program (ESTEP) program, in 2023, the Election Assistance Commission (EAC) completed its first voluntary e-poll book pilot to determine if federal certification is a viable solution for the future of e-pollbook usage during elections in the United States. As part of the ESTEP e-pollbooks pilot, the Voluntary Electronic Poll Book Requirements (VEPBR) were developed in collaboration with NIST and include reporting of the user-centered design process and usability testing requirements. This publication is intended to provide a deep dive into how to evaluate the usability and accessibility of e-pollbooks in order to meet these VEPBR requirements as well as any state certifications pertaining to usability and accessibility.

This report is Part 1 of the complete report on the usability and accessibility of e-pollbooks:

NIST VTS 100-3pt1: Usability and Accessibility of Electronic Pollbooks: Usability in the Polling Place

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NIST VTS 100-3pt2sup1: Usability and Accessibility of Electronic Pollbooks: Checklists for Usability and Accessibility

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Introduction

Over the last half century, voter registration lists have moved from paper to centralized digital state databases. Electronic poll books (e-pollbooks) extend this technology to the polling place, providing a digital system to look up, identify, and authorize voters, rather than relying on printed poll books.

E-pollbooks also make new options for election administration possible. These new features include things as simple as making it possible for poll workers to help a voter find their correct polling place and printing a map of the location. They also include more profound changes like real-time data updates that help reduce the number of provisional ballots and make vote centers¹ possible.

The project reported here was an investigation of what makes e-pollbooks usable for election officials, poll workers, and voters. The goal was to understand good practice for designing the interface and interactions, and how e-pollbooks could be evaluated for usability.

Many new e-pollbooks have been developed since the Federal Voluntary Voting System Guidelines (VVSG) 1.0 was approved in 2005 and VVSG 1.1 was first proposed in 2009. The wider use of e-pollbooks also coincides with wide availability of mobile devices including smart phones and tablets and other new technologies. This combination of events has made e-pollbooks a natural experiment in the uses of new technologies in election systems as vendors and election officials have explored options to find the solution that works best for their needs.

There are few—if any—standards for usability written for them. They are not covered by VVSG 1.0, and information about them is fragmented, making it hard to get a good picture of the state of the art. Standards and requirements for e-pollbooks are decentralized, managed by states and counties, with only a few states having formal standards for e-pollbooks. There is even less information available about their usability. The few formal state e-pollbook certification programs have minimal or no usability requirements.

This report is a first step in filling this gap, with a review of the current landscape for e-pollbooks, focused on their usability and accessibility. We include accessibility as part of usability issues because both poll workers and voters who may have disabilities interact with these systems. It focuses on:

- The role e-pollbooks play in the polling place
- Election officials' goals in adopting them
- Their usability for poll workers and voters

Research described in this report was conducted in 2017. The use of e-pollbooks presented throughout the document reflects the state of elections in 2017. In the time since this research was performed, e-pollbooks have made progress addressing usability and accessibility issues. Additionally, as part of its ongoing Election Supporting Technology Evaluation Program (ESTEP) program, in 2023, the Election Assistance Commission (EAC) completed its first voluntary e-poll book pilot to determine if federal certification is a viable solution for the future of e-pollbook usage during elections in the United States². As part of the ESTEP e-pollbooks pilot, the Voluntary Electronic Poll Book Requirements (VEPBR) were developed in collaboration with NIST

¹ Vote centers are polling places that are set up to handle voters from an entire jurisdiction rather than just those for a single precinct or district. The large number of voters makes paper lists impractical; the fact that voters can vote in more than one physical location requires synchronized updates of voter check-ins at all locations.

² <https://www.eac.gov/voting-equipment/estep-electronic-poll-books>

and include reporting of the user-centered design process and usability testing. This publication is intended to provide a deep dive into how to evaluate the usability and accessibility of e-pollbooks in order to meet these VEPBR requirements as well as any state certifications³ pertaining to usability and accessibility.

About this report

This report can help to develop a better understanding of usability for poll workers and voters using e-pollbooks. It includes:

- An overview of the considerations for e-pollbook usability in the polling place
- An analysis of the design elements that make up the interface to an e-pollbook
- A summary of our fact-finding on e-pollbooks and their practical use around the country

The information in the report comes from demonstrations of e-pollbook systems, poll worker manuals and training materials from several jurisdictions, and reviews of reports from election officials about pilot studies or other projects to consider the use of e-pollbooks in their jurisdiction. Specifically, demonstrations were with:

- 20 state and local election officials
- 11 models of e-pollbooks
- 4 systems built by election departments

The focus of the fact-finding was on the usability of e-pollbooks, particularly for poll workers, as well as how election staff used them before, during, and after Election Day.

The largest section of this report, Using an e-pollbook: design analysis, looks at the key interface features and functions of an e-pollbook and suggests design principles for usability as well as considerations for a designer (or someone evaluating a system).

It also shows examples of patterns for each interface element to explain differences in approach visually.

This is not a review of specific products. Instead of the usual practice of showing actual screen shots to illustrate design issues, we have created sketches and diagrams to show different approaches to interactions with e-pollbooks.

What this report is not

Although we touch on some of the legislative and policy constraints, this is not a comprehensive review of election code requirements for e-pollbooks or all variations of how e-pollbooks are used in election administration. Data from the National Conference of State Legislatures (NCSL) report⁴ on use of e-poll books provided helpful and thorough background information.

³ EAC clearinghouse of state certification requirements for electronic poll books <https://www.eac.gov/testing-and-certification/state-certification-requirements-electronic-poll-books>.

⁴ Electronic Poll Books (updated 5/11/2015) <http://www.ncsl.org/research/elections-and-campaigns/electronic-pollbooks.aspx>

This report does not include all products available. In particular, we know that there are many systems that are developed by election offices that we were not able to review.

It does not cover all of the technical functions of e-pollbooks products, except as they might affect their usability. In particular, it does not cover:

- The details of how e-pollbooks interoperate with official voter registration databases
- A review of administrative functions available at the polling place
- The security of the technology
- How voter identity is verified at the polling place
- Voter registration practices such as election day registration or guidelines for what updates can be made at a polling place
- Other customizations for specific jurisdictions

This report does not make recommendations for particular e-pollbooks products or provide a feature comparison table for e-pollbooks products beyond a high-level look at the hardware and form factor differences in the Appendix.

Overview of e-pollbooks in an election

Reported in this section is the results of the landscape analysis of the state of e-pollbooks and the process that e-pollbooks are typically used in during elections. Also presented is the formal definition of e-pollbooks used in these analyses.

The findings from the landscape analysis of e-pollbooks show consistent findings about the current state of their use. First, e-pollbooks include commercial systems, often created as an extension of the offerings to existing voting systems, voter registration databases, election management system, or poll worker support systems. Although there is a mix of both laptops and commercial tablets, most electronic pollbooks run on standard hardware and are sold as software and service rather than dedicated self-contained systems. Additionally, some states are building e-pollbooks that connect directly to their state-wide voter registration database.

Second, the functions and technical architectures of e-pollbooks are highly varied. Some are tightly integrated with a voting system both authenticating voters and activating an electronic ballot. Others are a local copy of the voter registration database used to check voters in, but with no other connection during Election Day.

Third, most e-pollbooks have similar core features, but are differentiated by how those features are implemented and by the additional features they offer. Whatever other features they include, all e-pollbooks provide the same core functionality: checking in voters and recording that they voted. Almost all also support a method to update the voter history in the master central voter registration database.

Finally, there are many variations in how e-pollbooks are used and significant differences in their design and usability. Those differences can have a significant impact on how easy it is for the poll workers, who work a very long day, to quickly and accurately complete the check-in process and other associated activities.

While e-pollbooks have these commonalities, the findings show a variability in the types and style of e-pollbooks used during elections. Therefore, one of the first steps in this project was to define what an e-pollbook is. The Presidential Commission on Election Administration (PCEA) stated in their “The American Voting Experience” report⁵ that, “An e-pollbook is an electronic version of the paper pollbook. It is simply a list of eligible voters in the relevant jurisdiction, which traditionally has been organized alphabetically or by address of the voter.” We offer a more active definition, in keeping with our interest in the usability of e-pollbooks:

An e-pollbook is a computer-based system that allows poll workers to look up voters and either check them in to vote or identify the person as not in the list of voters permitted to vote at the polling location.

In checking-in voters, using an e-pollbook in an election requires managing voter registration data throughout the entire election administration process, as shown in Figure 1.

⁵ The report is available on the PCEA website: <http://www.supportthevoter.gov/>



Figure 1. Voter registration data management process

The data is transformed at each step. Along the way, many different groups of people interact with the system:

- Election officials extract the local dataset (usually a single county or precinct) from their registration database. The master source can be either a local or state-wide database.
- Election officials (or vendors) transform the database into the correct format for the e-pollbooks so it can be loaded on the machines.
- During Election Day (or early voting days), poll workers interact with the system, updating voter records.
- Voters also interact with the system, through their signatures or by providing ID cards to scan. Ideally, they will also have the opportunity to check that the voter record found is the correct one by confirming information on the screen.

At the end of Election Day, this process is reversed to update the voters' history.

Beyond the basic functions of managing the voter registration lists, there are many variations in additional features of the existing e-pollbooks. Some are based on differences in election administration and laws, as well as the voting system used in conjunction with the e-pollbook. But, another source of differences in e-pollbooks is the background of the developers and their other election products. For example:

- Companies with voter registration systems tend to see the e-pollbook as an extension of the database and place more emphasis on updating and managing voter records. This is particularly true for e-pollbooks created or managed by the state election offices as a front-end to the state-wide voter registration system.
- Companies whose previous work includes support tools and processes for election administration are more likely to include features to manage the polling place in the e-pollbook.
- Companies focused on poll workers and their role in the polling place often include training and support functions such as poll worker attendance or other polling place management features.
- Voting system vendors often start with an e-pollbook that creates the activation tokens for the voting system. Similarly, companies with ballot-on-demand printers integrate that functionality into the e-pollbook.
- Some developers take a minimalist approach, wanting the least complex software; others want to maximize the value of the new systems in the polling place.

Despite these differences and variations, the cycle of Election Day enforces a general consistency in the workflow, shown in Table 1.

Table 1. The e-pollbook "journey"

	E-pollbook Activities
Pre-Election	
Prepare	<ul style="list-style-type: none"> – Pull voters records and convert to e-pollbook format. – Set up e-pollbook for polling places: ballot style or other election data.
Load	<ul style="list-style-type: none"> – Load data to the e-pollbooks (via server, network or transfer media). – Set up poll worker access and passwords.
Election Day	
Opening	<ul style="list-style-type: none"> – Set up and turn on e-pollbook. – Enter or download any updates to the voter records. – Communicate online status to the central office.
Polls Open	<ul style="list-style-type: none"> – Check in voters and update voter history. – Handle exceptions, including: <ul style="list-style-type: none"> • Provisional ballots, • Changes to voter records or election day registration, and • Redirect voters. – Communication: message and updates to and from the election office. – Communicate online status and election progress updates. – Data updates during the day, including mid-day voter activity reports.
Closing	<ul style="list-style-type: none"> – Close election day operations. – Run final reports for closing and end-of-day reconciliation. – Upload final data to server.
Post-Election	
Return	<ul style="list-style-type: none"> – Collect data from e-pollbook and add it to elections results system.
Reports	<ul style="list-style-type: none"> – Election checks and reports for turnout, audit, reconciliation. – Communication with public and media as part of election results.
Voter History	<ul style="list-style-type: none"> – Update voter history in local and state database. – Voter and turnout analysis.

Usability of e-pollbooks in the polling place

Usability is a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks⁶. In this case:

- The product is the e-pollbooks.
- The users are the poll workers (and sometimes, the voters).

The tasks are the different scenarios for checking in a voter and issuing them a ballot or authorizing them to vote, along with managing updates and other Election Day “housekeeping.”

The efficiency is a measure of how quickly poll workers can complete both routine and unusual tasks. Efficiency is important because checking in voters is one of the bottlenecks that can cause long lines at a polling place.

Effectiveness is measured by the accuracy with which poll workers can handle each voter. For example, can they:

- Find and identify the correct voter registration record including records that are easily confusable such as Jr/Sr or similar and common names?
- Recognize special conditions, such as whether the voter has already voted or identification requirements?
- Take appropriate action to check the voter in or deal with special requirements?
- Complete administrative procedures such as logging unusual events or updating records?

Finally, satisfaction is a measure of poll workers’ attitude towards e-pollbooks. This includes both positive attitudes and lack of negative attitudes about them. For example, do they believe that e-pollbooks:

- Help them do their job well?
- Make finding voters easy?
- Let them check voters in quickly?
- Help them interact with voters in a helpful way?

Scenarios for use

The most basic scenario of use for poll workers is to check in a voter. This means they:

- Find a voter in the database
- Review the voter record to confirm their identity
- Collect the voter’s signature or other identification, if needed
- Issue the ballot or any authorization materials
- Mark the voter as having voted

⁶ This definition is taken from ISO: 9241:11:2008. A slightly early version from 2008 is used as a reference in the Voluntary Voting System Guidelines definitions. The formal definition text is that usability is “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.”

Because this scenario is repeated over and over during an election day, the most important usability attributes of e-pollbooks are the efficiency and accuracy with which poll workers can complete the interaction.

Poll workers also routinely handle a number of common problems, exceptions, and updates. For these scenarios, it is also important that e-pollbooks support the poll workers through accurately completing tasks such as:

- Collecting or confirming identification for a newly registered voter
- Checking addresses of voters
- Identifying voters who are in the wrong polling place and providing information about the correct polling place
- Handling voters marked as having received a mail-in ballot or having already voted
- Issuing a provisional ballot
- Collecting information about someone assisting a voter

E-pollbooks usually include ways to handle updates to the voter registration record and Election Day Registration, where allowed. There is considerable variety in how updates are handled, based on both the capabilities of the system and legal or procedural constraints. Updates and notifications can include:

- Updates to addresses
- Name changes
- Marking a voter who may have moved out of the jurisdiction

Many e-pollbooks also include additional functions to support poll workers or election administration processes. These include:

- Communication of status and summary reports to the election office
- Chat or messaging functions between poll workers and election office
- Help and support such as poll worker training and procedure manuals

Finally, many of the e-pollbooks are software programs that run on general computers or tablets, so although not formally part of the e-pollbook functions, many systems also include, or are closely linked to, election administration functions, including:

- Poll worker rosters and attendance for payroll
- Equipment and supplies inventory
- Reporting tools and forms

Evaluating the usability of an e-pollbook

There are many ways to evaluate the usability of a system or product, from expert reviews against a checklist of best practices to a variety of methods for collecting input from people who might use the product, (demonstrations, feedback surveys, and focus groups), to analyzing statistics from the product in use (web or search results analytics or statistics about access from a server). However, the “gold standard” for evaluating usability is to observe people using the system either as they work or in an environment set up for this purpose – called usability testing.

Usability testing has several benefits:

- It can be done before a system is completely developed or deployed, to improve the design.
- It can be structured to cover both typical and less typical tasks, testing learning as well as repetitive tasks.
- People using the system can be observed without interfering in a real work environment.
- Participants can be interviewed to gain insights about their actions, especially how they solved problems in completing a task.

When combined with other evaluation methods, such as early reviews or pilot tests, usability testing is an important tool in ensuring that election systems work well in the high stakes of an election day.

When we think about evaluating the usability of an e-pollbook, one of the challenges is that it is used in very short interactions that can be hard to observe. Since some readers may be familiar with usability and NIST’s work supporting the development of a performance test for voting systems⁷, highlighted here are differences between evaluating the usability of a voting system and an e-pollbook, shown in Table 2.

Table 2. Comparison of usability testing for voting systems and e-pollbooks

Voting Systems	E-Pollbooks
<ul style="list-style-type: none">• Short interaction (marking and casting a ballot)• Many users (voters)• Completed once by each user	<ul style="list-style-type: none">• Short interaction (finding and checking in a voter)• Few users (poll workers)• Completed many times by each user

Accuracy is critical in both interactions, but there is additional pressure for efficiency in using an e-pollbook.

In making purchase decisions, election officials want e-pollbooks that are intuitive to use, facilitating successful elections while minimizing complaints from voters and poll workers. Election officials often use events like open vendor fairs or asking a few poll workers to “try out” an e-pollbook.

⁷ Preliminary Report on the Development of a User-Based Conformance Test for the Usability of Voting Equipment - <http://www.nist.gov/itl/vote/upload/032906User-BasedConfTesting3-10-06.doc> and

Overview of Proposed Human Performance Metrics for Voting Equipment - <http://www.nist.gov/itl/vote/upload/032906performance-metrics3-10-06.pdf>

Although the informal methods mentioned above can provide a general sense of the intuitiveness of an e-pollbook, a usability test provides richer and more comprehensive data. A good usability test has the following features:

- Simulates “real world” conditions, such as a room similar to a polling place and a mock election in which “voters” are checked-in (but don’t vote).
- Covers a broad range of scenarios, both common and uncommon. The “voters” present pre-selected scenarios. The scenarios represent the situations the poll workers will encounter.
- Includes a range of poll workers using the system (first timers, inexperienced, experienced) with each being presented with the full set of scenarios
- Focuses on observing and taking notes on the poll worker experience (what was easy, what was difficult, how was the overall experience, etc.)
- Includes enough sessions (typically 8 – 12) to ensure that a variety of experiences using the e-pollbook are included in the test.

Usability testing can be used in this context to provide information on the intuitiveness of an e-pollbook. The results can be used for several different purposes:

- Evaluating an e-pollbook being developed or customized to improve the system’s overall design.
- Identifying tasks or procedures that need emphasis during poll worker training or voter education.
- Testing a system for state certification or approval.
- Comparing different e-pollbooks to help make a purchase decision.

If the usability test is run with a single e-pollbook product, the results can be analyzed to determine:

- What scenarios did all poll workers complete successfully?
- What scenarios did most or all poll workers have problems with?
- How consistent are the types of problems poll workers had?
- How similar are the number of different problems each poll worker had?
- Are there differences in success rates for experienced, inexperienced, or first-time poll workers?

If the usability test is run on e-pollbooks from more than one manufacturer, the results can also be analyzed to determine:

- What differences were seen in the completion rates for common/uncommon scenarios between the e-pollbooks?
- What differences were seen in the completion rates for experienced/inexperienced/first-time poll workers between the e-pollbooks?
- If your poll workers participated twice, once on each e-pollbook, what is their subjective reaction to the e-pollbooks? Do they have a preference and why?

Note that roughly equivalent acceptable results between e-pollbooks from different manufacturers means the purchase decision can focus on other factors.

NIST VTS 100-3pt2 – Usability and Accessibility of Electronic Pollbooks: A Usability Test Protocol is Part Two of this report series. It contains a complete description of the usability test protocol. It can be found at <https://doi.org/10.6028/NIST.VTS.100-3pt2>.

Using an e-pollbook: design analysis

For a first analysis of the interfaces of e-pollbooks, we started from the basic scenarios for use. We saw demos of many of the commercial e-pollbooks as well as some built by election departments. We also investigated how election officials integrated e-pollbooks into their election administration processes.

The goal of this work is to provide a starting point for a better understanding of the usability of e-pollbooks to help both people developing these systems, and people using these systems, make good decisions about how to design, select, and deploy them. This project did not include investigation or observations of the process of setting up the e-pollbooks in the polling place. The ease of setup is also important for a complete picture of the usability of e-pollbooks. For example, setting up local networks (or “daisy chains”) of e-pollbooks or systems that have complicated peripherals can be a challenge for poll workers.

We looked at the ways that different e-pollbooks support some of the most common tasks and interactions. This analysis does not draw any conclusions about which designs are best. In fact, there are often several ways to design an interaction with good usability.

The interactions we examine in detail are:

- Basic voter check in
- Find a voter by scanning an ID
- Finding a voter by searching
- Reviewing the list of voters found
- Checking voter status
- Checking voter details
- Handling updates and exceptions
- Collecting signatures
- Helping voters in line
- Entering text with an on-screen keyboard
- Supporting poll workers
- Accessibility

Each interaction is presented with the information in Table 3. Many of the interactions also include a sample diagram of the interaction with an e-pollbook.

Table 3. E-pollbook interaction sections description details

Section	What it contains
What	A brief description of the interaction and the task it supports
Why it is important	How this is important for usability
Usability guidelines	Design principles that apply to this interaction
Design considerations	Questions to ask about the design of this task that affect usability

Section	What it contains
Common variations	Different approaches to the interaction in current e-pollbooks

Basic voter check in

What

The core task: checking in a voter, starting from the opening screen. This task assumes a voter who is registered to vote, eligible to vote in the election, in the correct polling place, with all necessary identification and no status warnings.

This section is focused on the beginning and end of the basic voter check in. Steps and activities within the process are discussed as a part of other interactions.

Why it is important

It is the repetitive path through the interface that will be used most often. The poll worker needs to be able to do this quickly and accurately.

Usability guidelines

- Efficient: Can poll workers complete this task quickly?
- Effective: Can poll workers complete this task accurately?

Design considerations

- How complex is the opening screen for the check-in process, the screen used as “home base”?
- How easy is it for the poll worker to start over after checking-in a voter?
- How obvious is the starting point for finding a voter record?
- How easy is it for a poll worker to return to the search results (list of voters)? For example, when checking in members of the same family in succession or when the first voter selected is not correct.
- How many different actions or screens does the poll worker have to navigate to complete this task?

Common variations

- The “home base” may be dedicated to the core function as a voter roster or may be shared with other election or polling place administration functions.
- The poll worker may have to decide between searching or scanning to find a voter as the first step.
- The interaction to find a voter may take place on several screens or in a single screen that changes through a task.
- At the end of checking in a voter, the system may reset to a variety of screens.

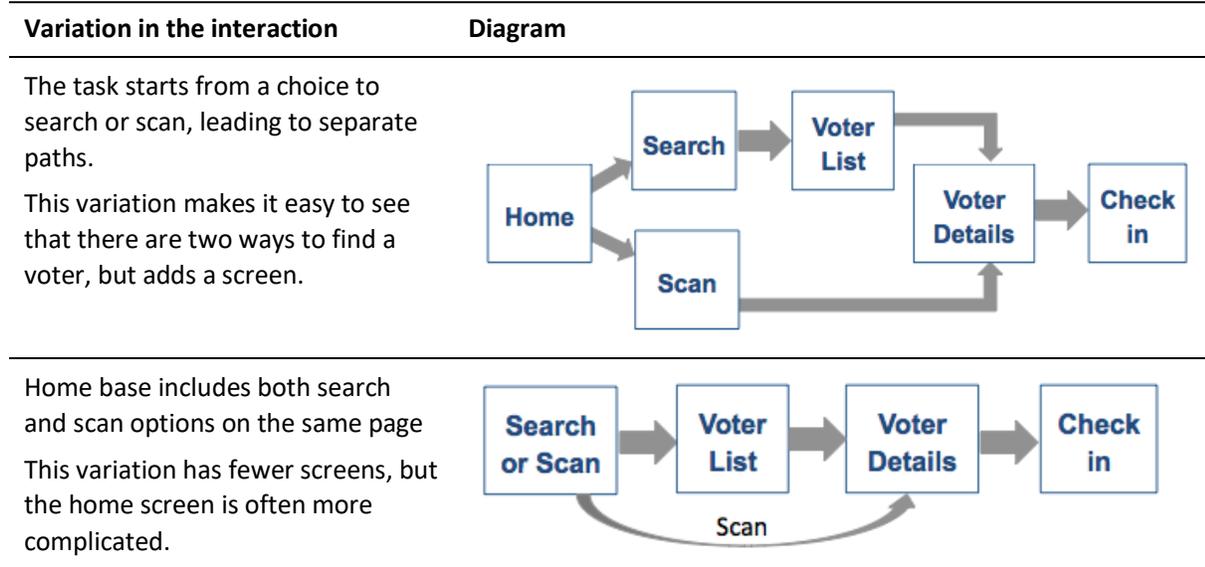


Figure 2. Sample diagram of interaction: Basic voter check in

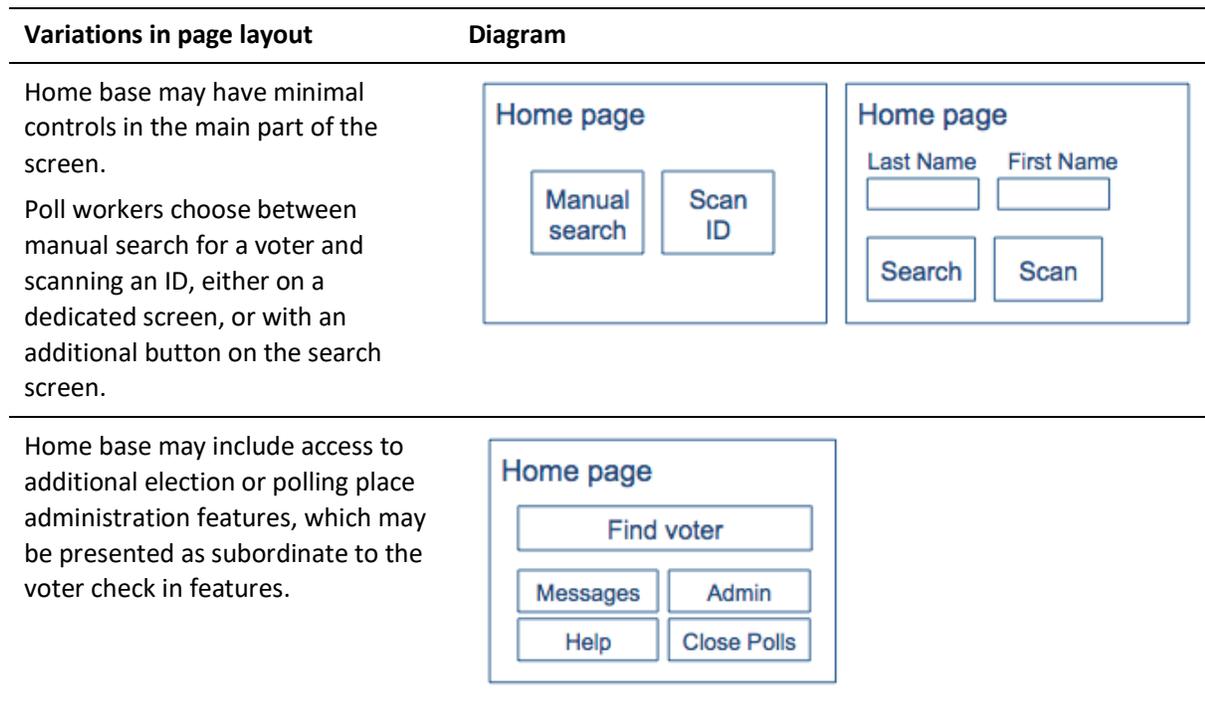


Figure 3. Sample diagram of "home base" page layout

Find a voter by scanning an ID

What

Using a QR code or barcode on an ID card to look up the voter record. This ID is most often a driver's license, but can also be a voter registration card, a sample ballot mailed to the individual, or any other legally accepted ID.

Why it is important

This is a part of the core task (basic voter check in). Fast accurate voter lookup can help reduce long lines. Using an ID card can make the process both faster and more accurate.

Usability guidelines

- Efficient: Can poll workers and voters quickly and easily position the ID card for scanning?
- Effective: Can poll workers accurately identify the voter found by the scanning process? Does the system support this by highlighting distinguishing elements in the voter record such as gender and age?
- Example: A voter might use a sample ballot as ID, coded as belonging to a different voter in the same household, or from the wrong district not knowing that they are personalized.
- Satisfaction: Are voters and poll workers comfortable using the scanning feature?

Design considerations

- Voters are part of this interaction. In states where the ID is used as a convenience (rather than a legal requirement) do they accept using it to sign in?
- Are voters comfortable with how their ID is handled? There is less opportunity for the ID to get lost if only the voter handles it.
- Do the poll workers see the ID card, and can they use it to compare the details to the voter record found?
- What does the system display if there is a problem with the scan?

Common variations

- Different scanning methods, such as built-in cameras, external devices that add visual scan or swipe mechanisms.
- Whether the poll worker or the voter handles the ID card
- Whether or not the poll worker sees an image of the ID on-screen.
- Number of steps required to read the card and find the voter.

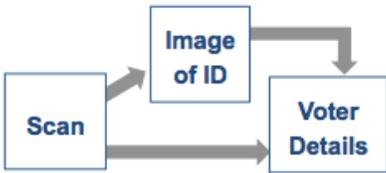
Variations in the interaction	Diagram
<p>Some systems include a stand with a location for voters to place their card for accurate scanning.</p> <p>This also means the voter holds on to the card, instead of handing it to the poll worker.</p>	 <p>Voter Pollworker</p>
<p>Other systems have the poll worker take the ID from the voter to scan it.</p>	 <p>Voter Pollworker</p>
<p>The system may show the poll worker an image of the ID card, or simply read the QR or barcode and go directly to the voter details page</p>	

Figure 4. Sample diagram of interaction: Find a voter by scanning an ID

Finding a voter by searching

What

Finding a voter by entering name, address, or other details.

Why it is important

this is a part of the core task (basic voter check in). Fast lookup can help reduce long lines. Accurate lookup and handling of potential issues with items such as confusable names, status indicators, and similar addresses is critical.

Usability guidelines

- Efficient: Can poll workers find voters with minimal typing?
- Efficient: Does the system respond quickly with the results list?
- Effective: Can poll workers accurately identify the voter in a list?

Design considerations

- How many fields must be filled in before launching a search?
- Are the fields arranged for easy entry, including access to additional fields?

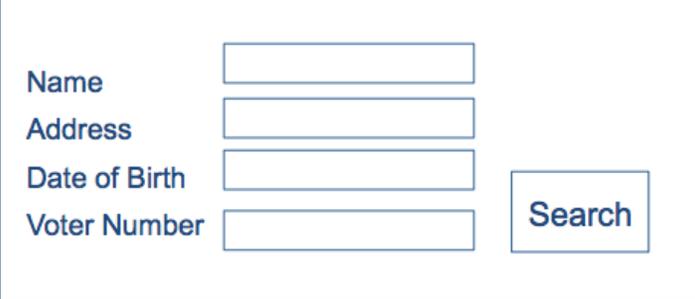
- Does the search only look for matches in specified fields, or anywhere in record?
- How does the system prompt poll workers to refine the search when the result is a long list of potential voters?
- Can poll workers easily see how many voters are found in a search?
- How is the search initiated? Do results automatically display and start to narrow as criteria are entered or not until the search is launched?
- Does the poll worker have to choose the scope of the search (precinct, county, state, inactive)?

Common variations

- The initial search form includes a wide variety of fields, from just name to all possible fields. Additional fields may be shown with a tab or radio button control to change the search form.
- The search may be initiated with a simple search button, selection of a search scope, or be automatically initiated by the program.

Typical search options include:

- Name or First Name, Last Name, Middle Name/Initial, Suffix
- Address or Street Number, Street Name, City, Zip Code
- Date of Birth or Age
- Voter Registration number or other ID number
- A single field for all search criteria

Variations in the search form	Diagram
<p>Some systems have separate search forms for finding a voter in different ways, and use tabs or buttons to allow poll workers to switch between them</p>	
<p>A few systems included all of the fields at once, allowing poll workers to use any of them to find a voter, balancing clutter with efficiency.</p>	
<p>One system has a single search box which will search anywhere in the voter record, including name, address, or other details.</p>	

Variations in the search form	Diagram
<p>Systems that automatically filter the list of voters usually have a search button also.</p> <p>Some systems have separate search buttons or other controls to set the scope of the search, while others allow this filtering on the search results screen</p>	

Figure 5. Sample diagram of interaction: Find a voter by searching

Reviewing the list of voters (search results)

What

Identifying a voter correctly in a list of voters

Why it is important

This is a part of the core task (basic voter check in). Poll workers need to be able to quickly identify the right voter in a list, among other voters who may have similar names or addresses, knowing if they are in the wrong place, and determining if they have already voted or have any other special situations.

Usability guidelines

- Efficient and Effective: Does the interface help poll workers quickly and accurately identify the voter in the list, separating names “ready to vote” from those who need special attention?

Design considerations

What information is available in the list, and what information requires clicking into the voter record. Can a poll worker tell at a glance if the voter:

- Is ready to vote
- Has already voted
- Is in the wrong precinct
- Has any special status
- Might be easily mistaken for another voter (for example, Jr. vs Sr.)

If the voter is not in the list, can, and how, does the poll worker:

- Expand the search to include the county or state, or inactive voters
- Refine the search by adding additional information, or editing the search criteria?

How easy is it to scan the list?

- Is the typography helpful in showing the most important information?
- Is there enough space between lines?
- Are the most important elements visually differentiated?
- Is the information arranged for quick comprehension?

Common variations

- The search results list may be displayed on the same screen as the search form or on a new screen.
- There are many variations in the columns in the results list, and how names and other information are displayed.
- There are many variations in icons or other indicators for voter status. (see Checking voter status interaction description)
- Some systems mix all voters in a single results list, but can also be separated into the list of voters for the current precinct, followed by others in the county.

Variations in the layout	Diagram																																				
<p>If the entire county is searched, voters in the correct precinct are sometimes differentiated through how they are displayed, or by separating them into two lists.</p>	<table border="1"> <thead> <tr> <th>Name</th> <th>Address</th> </tr> </thead> <tbody> <tr> <td>Drinker, Jean</td> <td>57 Main Street, Bewyn</td> </tr> <tr> <td>Driver, John L</td> <td>1545 Tates Drive, Berwyn</td> </tr> <tr> <td>Driver, Melinda K</td> <td>1545 Tates Drive, Berwyn</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Name</th> <th>Address</th> </tr> </thead> <tbody> <tr> <td>Dougherty, Jordan</td> <td>23 Chestnut Street, Maple</td> </tr> <tr> <td>Drough, Mary J</td> <td>5774 River Road, Easton</td> </tr> <tr> <td>Dribner, Robert L</td> <td>54 Range Road, Franklin</td> </tr> </tbody> </table>	Name	Address	Drinker, Jean	57 Main Street, Bewyn	Driver, John L	1545 Tates Drive, Berwyn	Driver, Melinda K	1545 Tates Drive, Berwyn	Name	Address	Dougherty, Jordan	23 Chestnut Street, Maple	Drough, Mary J	5774 River Road, Easton	Dribner, Robert L	54 Range Road, Franklin																				
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<p>The format of the list and the order of the columns have an impact on how easy it is for poll workers to scan quickly to find a voter.</p>	<table border="1"> <thead> <tr> <th>Voter ID</th> <th>Last Name</th> <th>First Name</th> <th>MI</th> <th>Address</th> <th>City</th> </tr> </thead> <tbody> <tr> <td>95852348611</td> <td>Dougherty</td> <td>Jordan</td> <td></td> <td>23 Chestnut st.</td> <td>Maple</td> </tr> <tr> <td>76654123123</td> <td>Driver</td> <td>John</td> <td>L</td> <td>1545 Tates Drive</td> <td>Berwyn</td> </tr> <tr> <td>54788232367</td> <td>Driver</td> <td>Melinda</td> <td>K</td> <td>1545 Tates Drive</td> <td>Berwyn</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Name</th> <th>Address</th> <th>Voter ID</th> </tr> </thead> <tbody> <tr> <td>Dougherty, Jordan</td> <td>23 Chestnut Street, Maple</td> <td>95852348611</td> </tr> <tr> <td>Driver, John L</td> <td>1545 Tates Drive, Berwyn</td> <td>76654123123</td> </tr> <tr> <td>Driver, Melinda K</td> <td>1545 Tates Drive, Berwyn</td> <td>54788232367</td> </tr> </tbody> </table>	Voter ID	Last Name	First Name	MI	Address	City	95852348611	Dougherty	Jordan		23 Chestnut st.	Maple	76654123123	Driver	John	L	1545 Tates Drive	Berwyn	54788232367	Driver	Melinda	K	1545 Tates Drive	Berwyn	Name	Address	Voter ID	Dougherty, Jordan	23 Chestnut Street, Maple	95852348611	Driver, John L	1545 Tates Drive, Berwyn	76654123123	Driver, Melinda K	1545 Tates Drive, Berwyn	54788232367
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<p>Some systems highlight easily confused information such as the street number, or Jr/Sr/III</p>	<table border="1"> <thead> <tr> <th>Name</th> <th>Address</th> <th>Voter ID</th> </tr> </thead> <tbody> <tr> <td>Dougherty, Jordan</td> <td>23 Chestnut, Maple</td> <td>95852348611</td> </tr> <tr> <td>Driver, John L, Jr</td> <td>1545 Tates Drive, Berwyn</td> <td>76654123123</td> </tr> <tr> <td>Driver, John L, Sr</td> <td>1545 Tates Drive, Berwyn</td> <td>54788232367</td> </tr> </tbody> </table>	Name	Address	Voter ID	Dougherty, Jordan	23 Chestnut, Maple	95852348611	Driver, John L, Jr	1545 Tates Drive, Berwyn	76654123123	Driver, John L, Sr	1545 Tates Drive, Berwyn	54788232367																								
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Figure 6. Sample diagram of interaction: Reviewing the list of voters (search results)

Checking voter status

What

Identifying any special status for a voter including whether they have received a vote-by-mail/absentee ballot, are inactive, need to show ID or update their address, require assistance, or other special statuses used in a jurisdiction.

Why it is important

This is a part of the core task (basic voter check in). Critical for accurate handling of each voter.

Usability guidelines

- Efficient: Are status indicators shown at the earliest point in the work flow, so poll workers can act quickly to handle a voter correctly?
- Effective: Are status indicators easily visible, clearly distinct, and stand out on the screen?
- Effective: Do status indicators use colors in a way that match conventional use, such as using red for problems and green or blue for normal conditions?
- Effective: Are status indicators used consistently on all screens, and are not easily confused with any other icons or indicators?

Design considerations

- Does every voter have a status indicator, or only voters with a special status, or those who have already voted?
- What status indicators are shown in the results list versus situations that require going to the individual voter record?
- How many icons are there? Are they easy to understand, or hard to learn or easily confused. (Example: does a check mean active and ready to vote, or has voted?)

Common variations

- There are many different styles of icons and choice of indicators.
- Although red-amber-green or blue is often used for color coding status indicators for voted-problems-ready, there is not a lot of consistency across e-pollbooks.
- The status indicator is often shown in the results list, but may also only be shown on the voter detail screen.

Variation in the indicators	Diagram
Some e-pollbooks use a small number of icons and colors, for example, ready, voted, problems.	
Some e-pollbooks use words for the different status indicators.	ACTIVE VOTED ABSENTEE
Some e-pollbooks use abbreviations for the different status indicators.	ACT VOT ABS

Figure 7. Sample of voter status indicators

Checking voter details

What

Display of information about the voter, allowing poll workers to check their identity and address issues before issuing a ballot.

Why it is important

This is a part of the core task (basic voter check in). Critical for accurate handling of each voter.

Usability guidelines

- Effective: Do poll workers have access to the information and actions they need for each voter?
- Effective: Is information about the voter presented in a way that makes it easy to read, making key details easily visible?

Design considerations

Note: the design considerations listed here apply to all screens, but are especially important on the voter details screen

Is the screen designed so the most important information stands out and in a way that makes it easy for poll workers to scan the screen quickly?

- Is the most important information on the screen the most visible?
- Is there high contrast between text and background color so the information stands out well?
- Is the text large enough, with good spacing between lines or elements?
- Is color used effectively? Does it match conventional use (such as green for positive)?

Common variations

- Voter details may be shown as a form, or in a display format.
- There was a wide variation in how the actions from the voter information screen were displayed.

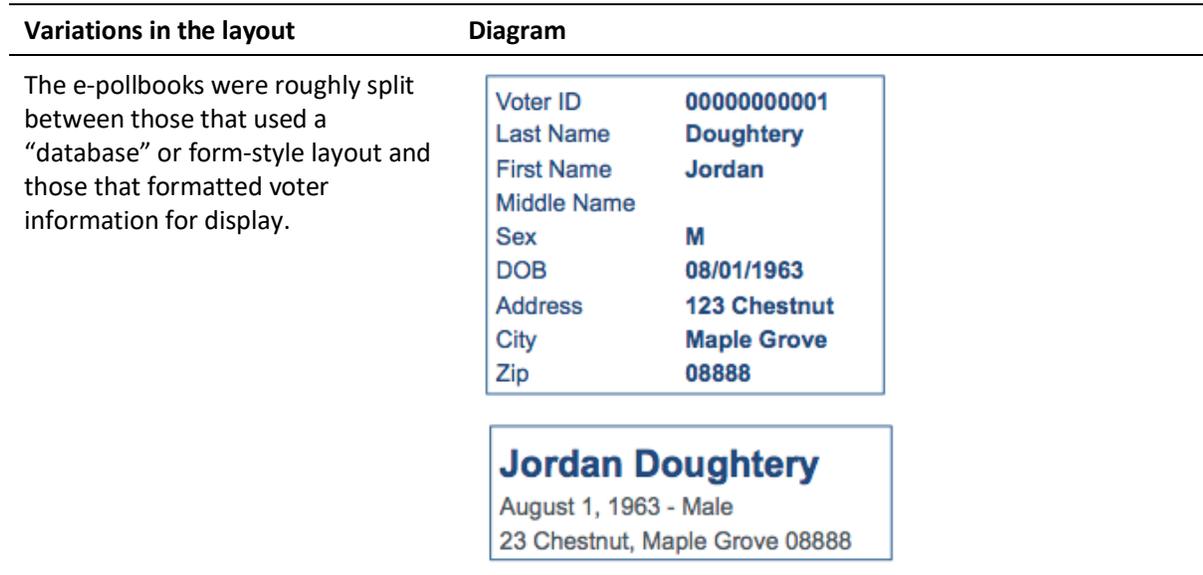


Figure 8. Sample diagram of interaction: Checking voter details

Handling updates and exceptions

What

The situations outside the basic check-in, such as provisional voting, election day registration, updates to the voter record, and other features such as entering notes.

Why it is important

When updates and exceptions are handled smoothly, the voter is reassured that the system is working well. If the poll worker seems to be having difficulty or taking a long time it can affect the voter’s perceptions, and create a bottleneck during the check-in process, leading to long lines.

Usability guidelines

- Efficient: Can poll workers complete tasks, especially those requiring data entry, in a reasonable length of time?
- Effective: Can poll workers complete all steps needed to address the exceptions?

Design considerations

- Are the controls to start, continue, or resolve an exception process clearly labeled and obvious?
- How easy are the screens to perform updates or other actions to locate and complete?
- How easy is it to collect information from the voters and complete any necessary actions?

Common variations

- The placement of controls to make changes varies widely, including edit buttons placed near each section of data and single buttons for each possible action.
- Entry forms are displayed in a series of screens, or in an overlay window.

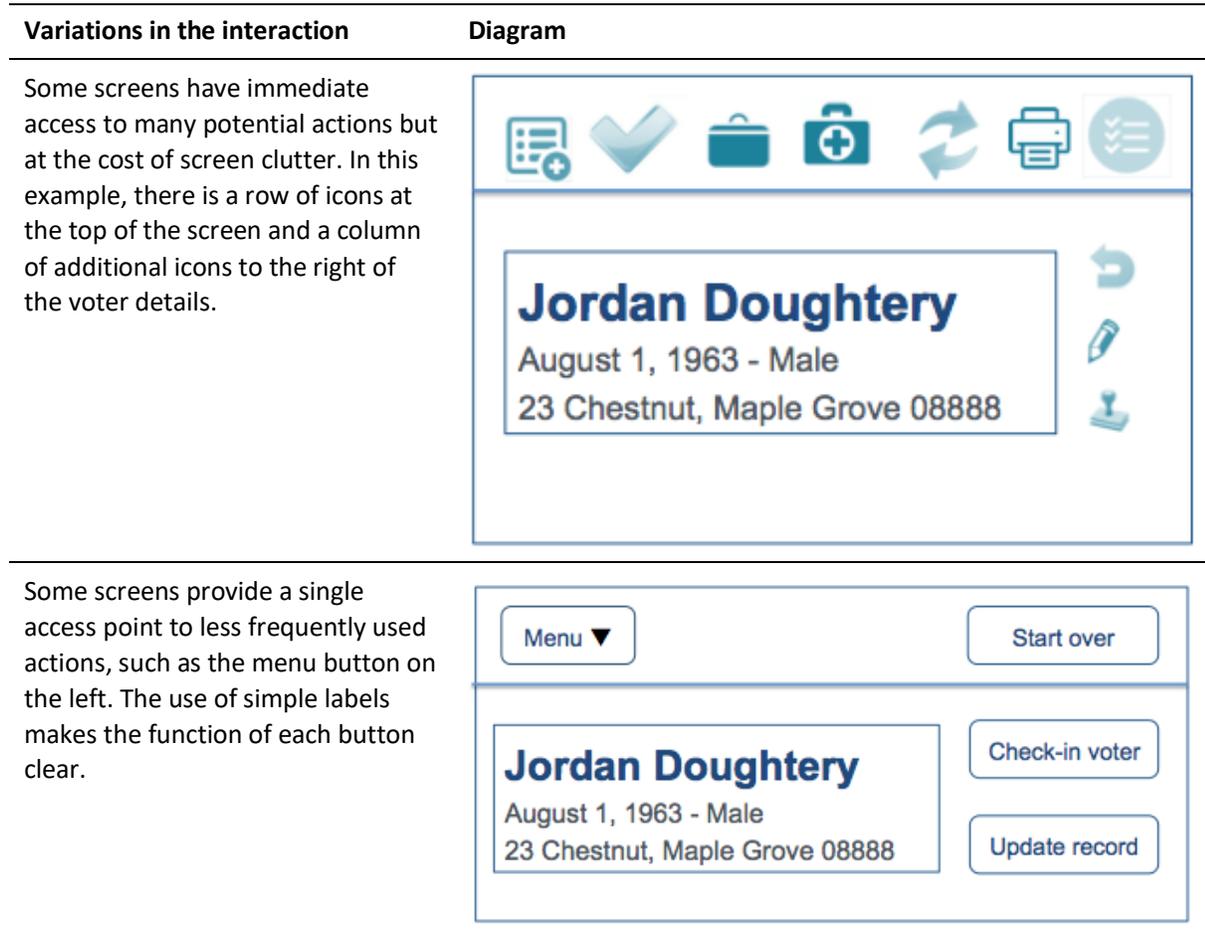


Figure 9. Sample diagram of interaction: Handling updates and exceptions

Collecting signatures

What

Voters often have to sign the poll roster. In an e-pollbook they can often sign electronically or sign on a printed slip of paper from an attached label printer.

Why it is important

There are often legal requirements around signature collection. The poll worker may have to compare the voter's signature with the signature on file.

Usability guidelines

- Effective: Can voters easily identify where to sign and fit their signature into the space?
- Effective: Can voters confirm their identity on the signature screen to reduce errors?
- Effective: Can poll workers confirm the signature as required?

Design considerations

For digital signatures:

- Does the voter sign on the screen or on a separate signature pad.
- For signing on-screen, how is the screen presented to the voter? (For example, tipped on a stand, rotated, or other.)
- Is the angle optimized to help voters produce a legible signature?
- Can voters use a stylus, or do voters have to sign with their finger. (Signing with a finger is more difficult than using a stylus on many types of signature pads.)
- Can the voter easily see where to sign and are they able to clear the signature, and sign again?

For signatures on paper:

- How easy is it to print the signature collection label or paper?

For all signatures:

- What information does the voter confirm that the poll worker has presented the form for the correct voter (name, DOB, address, etc.)
- If the poll worker is required to compare signatures how is this done?

Common variations

- Devices used to capture signatures vary.
- The signature screen has a wide variety of information, from the full voter record to no identifying information.

Variation in the interaction	Diagram
The signature screen may include information about the voter, instructions, or an oath or declaration	

Figure 10. Sample diagram of interaction: Collecting signatures

Helping voters in line

What

Providing directions and other guidance to get a voter to the correct voting place helps them vote whether it is direction to another location or the correct line in a multiple-precinct polling place.

Why it is important

Guiding voters to the correct polling place or line reduces provisional ballots and provides a more positive experience for voters and poll workers

Usability guidelines

- Efficient: Can poll workers quickly and easily identify the correct polling place without taking too much extra time?

- Effective: Can poll workers easily provide instructions to the voter in a useful form?

Design considerations

- Does the system include an option for a phone or small tablet to “work the line”?
- Is the “mobile” version of the e-pollbook easy to use with one hand, while standing?
- What features and information is included in the mobile version?
- Can the poll worker print directions or a map to give the voter?

Common variations

- Most e-pollbooks can provide the name and address of the correct polling place for a voter. Many can print this information, often with a map or directions.
- E-pollbooks with hand-held or small tablet systems to allow someone to look up voters standing in line can often display this information to share with the voter.
- Some e-pollbooks have a limited set of look-up functions in an app that can work on any phone, others have a dedicated companion app.

Entering text with an on-screen keyboard

What

Typing text using an on-screen keyboard rather than a standard keyboard

Why it is important

Typing on an on-screen keyboard is a different experience. Numerical, non-alphabetical characters, and accents are accessed differently. An on-screen keyboard also claims a large amount of screen space.

Usability guidelines

- Effective: Does the e-pollbook present the keyboard when needed, and hide it appropriately?
- Satisfaction: Does the appearance and hiding of the keyboard avoid intruding on the task or related information?

Design considerations

- How is the appearance and hiding of the keyboard managed?
- Can a user hide the keyboard manually? Does the mechanism to do this assume that the user knows the conventions of the platform?
- Does the keyboard hide information poll workers need or reduce the space for information on the screen?
- Is the keyboard customized for special characters poll workers might need?

Common variations

- The keyboard handling is related to the sequence of screens in search, especially the transition from entering a search to seeing the search results: some systems manage showing and hiding the keyboard automatically. Others jump to a new screen where the keyboard is hidden.

Supporting poll workers

What

Features to allow election offices to monitor and support poll workers:

- Scripts (words for the poll workers to say) and prompts (reminders and instructions) to help poll workers follow the correct sequence, or use consistent language where required in the flow.
- Messaging systems that allow election officials to broadcast updates or to answer questions without a phone call.
- Monitoring systems that allow election officials to see whether e-pollbooks are online, how many people have voted, and other data.

Why it is important

Helps central office stay in touch with the elections staff in the field. Reduces the amount of information poll workers have to remember. Also helpful for poll worker troubleshooting.

Usability guidelines

- Efficient: Can poll workers get answers to questions quickly?
- Efficient: Can election offices monitor the election remotely, from a central location?
- Effective: Are poll workers prompted to ask the right questions and handle voters accurately?
- Effective: Can poll workers ask questions or look up information from their training manuals easily?

Design considerations

- Are poll worker prompts or scripts customizable by the election administration staff or only by the vendor's staff?
- Is access to the poll worker training materials built-into the interface?
- Are messages or documentation easy to find without disrupting the flow of voters at the check-in table?
- If poll workers can enter notes about a voter, is this free-form text, or a selection of pre-written notes, or a combination?

Common variations

- Many of the systems have on-screen prompts and scripts.
- Some of the systems include complete poll worker operations manuals or support systems.
- A few of the systems include two-way chat/messaging capabilities.
- Some systems allow poll workers to enter notes about a voter to be reviewed by the elections office.

Variations	Diagram
Many of the systems dedicate a portion of the screen to customizable prompts. They may be in the form of a script.	

Figure 11. Sample diagram of interaction: Supporting poll workers via customizable prompts

Accessibility

What

Systems can be designed to enable customization for accessibility and may have custom controls that change display features or interactions. E-pollbooks on standard laptops or tablets can use the features of the platform to provide accessibility for poll workers.

Why it is important

Accessible e-pollbooks can enable people with disabilities to work as poll workers – which is also a good way to support voters with disabilities better.

Usability guidelines

- Effectiveness and Satisfaction: Does the system use platform capabilities for customizing the size of text, color and contrast, and supporting assistive technology where it does not interfere with election administration or security?

Design considerations

Does the system meet accessibility guidelines such as Section 508 or WCAG 2.0?

- Can the poll worker change the text size, set colors or change the background from light to dark?
- Does the system work with any built-in accessibility tools such as those that zoom the screen or read information out loud?
- Does the system work with a built-in or add-on screen reader so people who rely on this assistive technology can use the e-pollbook?

Common variations

At the time of this landscape analysis, very few of the vendors or election office designers mentioned accessibility. We saw system(s):

- Aiming for Section 508 certification
- With a control to allow poll workers to change the text size
- That do not allow the text to be resized or contrast changed
- That use bright red and green colors on buttons, and also have meaningful text labels.

E-pollbooks in election administration

Although this report is focused on the usability and accessibility of e-pollbooks as they are used at the polling place, it is helpful to consider how they fit into the overall administration of an election and what goals they can support.

To understand why e-pollbooks are being adopted so rapidly, we investigated the benefits local election officials saw in adding another piece of technology to the polling place. E-pollbooks have the potential to:

- Make current procedures easier or more accurate,
- Improve election administration,
- Enable new ways of conducting elections,
- Monitor activity at polling places more effectively,
- Remove roadblocks to practical use of e-pollbooks, and
- Consider impact on people in the election process, including election staff, poll workers, and voters.

Make current procedures easier or more accurate

Updating voter history in the state or county database after an election is often much easier from e-pollbooks than from paper poll books. In some cases, voter records can be more accurate because there are fewer errors in transcribing hand-written records from paper poll books to the database.

Improve election administration

The following polling place activity analyses could be beneficial to election officials:

- Number of voters checking in at the polling place during the day. These patterns could help election officials manage lines better in the future.
- Data on updates such as address changes made during the day.
- Capturing notes from poll workers on problems they encountered when interacting with voters.

Enable new ways of conducting elections

It is not possible to run an election where votes are cast at the polling place⁸, in which voters have a choice of polling place, without a way to have immediate updates to the voter history. Vote centers in county offices can use an official network within their building to connect to the voter registration database, but extending vote centers to additional locations in order to have sufficient vote centers to support an entire election requires connected e-pollbooks.

⁸ Some jurisdictions with unconnected vote centers or early voting locations place ballots in envelopes like a vote-by-mail ballot and only check whether the ballots are eligible to count at a central location.

Even in states where legislation does not allow vote centers, election officials are aware of this trend in elections and are considering how to build their election administration procedures so that they are ready if laws change.

Monitor activity at polling places more effectively

Many of the e-pollbooks have the capability of maintaining an Internet connection to a central portal that the election office can monitor. This capability can be useful in several ways:

- It makes is possible for election officials to see all of the polling places “come online” in the morning, so they get a positive indication that they are set up and ready for voters.
- Election officials can communicate with poll workers during the day to solve problems or push updates in the voter registration database to them.
- Election officials can see how busy each polling place is, gauging turnout during the day and being prepared for supplies shortages.

Remove roadblocks

The single biggest negative aspect of e-pollbooks is that they are another piece of technology that must be purchased and maintained. Budgets are limited within some election offices, and also tight in county budgets where elections compete with many other priorities.

Consider impact on the people

Adding a new technology or procedures affects election officials, poll workers, and voters. Elections offices are already working with voter registration databases, but adding new technology in the polling place to interface with those databases requires purchasing and managing the devices, new procedures, and new training needed for the elections staff.

Since poll workers have to learn new technology, e-pollbooks need to be easy to use for older workers, especially if they have limited prior use of computers or tablets. However, there were few reports of problems, and more about how poll workers liked the e-poll books. One vendor had to put a new e-pollbook into operation at some polling places with virtually no training – there were minimal problems.

Finally, election officials should minimize the impact on voters to facilitate the change from paper rosters to the new e-pollbook devices.

E-pollbooks in state election codes

State legislation on e-pollbooks is a rapidly changing landscape. Not only is there wide variety in current rules, but there are also efforts to update state laws in many states.

State election codes address e-pollbooks in three main ways, from explicitly allowing them, having language that prohibits their use, or being neutral, written in a way that offers flexibility for both paper and e-pollbooks (see Table 3).

Table 3. How e-pollbooks are addressed state election codes

Status	Language in the election code
Prohibited	Language explicitly prohibits the use of e-pollbooks or includes language that effectively disallows them.
Neutral	There is no language or procedures in the code that cannot be done with e-pollbooks.
Allowed	Explicit language allowing e-pollbooks or specifying procedures for their use.

State election codes illustrate the range of current legislative landscape⁹:

- In Connecticut, recent changes to state law allowed the use of e-pollbooks by making minor changes to the existing language to allow functions to be done manually on paper or electronically.
- In Minnesota, the Electronic Roster Pilot Project (201.225) authorized the use of e-pollbooks with specific requirements, such as the degree of network access allowed, and authorized pilot tests of systems.
- In Colorado, HB1303 made sweeping changes in 2013, mandating a Uniform Voting System that includes the use of vote centers, which require the use of e-pollbooks.
- In Wisconsin, investigations into the use of e-pollbooks were suspended after an initial phase because of concerns about cost, usefulness, and the use of networks in polling places. In September 2015, work began on the development of standards for testing and approval of e-pollbooks.

Election requirements affecting e-pollbooks

Election codes have a wide range of specificity in requirements that affect e-pollbooks. For example, a requirement for voter signatures might simply require that they be collected, or specifically require that

⁹ The EAC maintains a clearinghouse with the most recent information on state certification requirements for e-pollbooks: <https://www.eac.gov/testing-and-certification/state-certification-requirements-electronic-poll-books>

they be on paper. Similarly, they might be written in a way that is broad enough to encompass both paper and digital signatures, explicitly allow digital signatures, or explicitly disallow them.

Requirements in election codes that affect e-pollbooks include:

- Compatibility with the file format of state registration databases
- Internet access and peer-to-peer networking within the polling place or between the polling place and elections office
- Whether (and how) voter signatures are collected, including paper and digital signatures.
- Voter identification requirements, or types of identification that voters might present at the polling place.
- Requirements for reconciliation and audit procedures, which might mandate reconciliation with the poll book records
- Voting system certification requirements and constraints on purchase decisions

Certification or approval of e-pollbooks

Where state election codes allow e-pollbooks, states may set constraints on which models may be used within the state (see Table 4).

Table 4. State requirements for approval of e-pollbooks

State requirements	Description and examples
No requirements	No requirements in the state election code. Counties may choose to use e-pollbooks or not.
Data compatibility only	Requires only compatibility with the state voter registration format.
Certification	E-pollbooks must be approved through a state certification process. Examples: <ul style="list-style-type: none"> • Indiana has a full certification process conducted by the state with an advisory Voting System Technical Oversight Program (VSTOP) at Ball State University • Ohio has an approval process conducted by a state board.
Approval	The state approves vendors and products from which counties may select, or approves products on a case-by-case basis, but without a formal certification process.
Single system	The entire state uses a single product. Local elections offices are either required to use it or must use it if they use an e-pollbook. <ul style="list-style-type: none"> • Michigan and Utah have a system managed by the state Department of Elections. • Colorado’s Uniform Voting System will include an e-pollbook.

State requirements	Description and examples
E-pollbook as part of a voting system	The e-pollbook is a component in a state-wide voting system. Example: <ul style="list-style-type: none"><li data-bbox="581 331 1354 399">• Maryland and Georgia have a single voting system for the entire state which includes an e-pollbook.

For more information

For a more complete national view of the legislative landscape, the National Conference for State Legislatures (NCSL) has extensive research on state campaign and election code which covers a wide range of topics including an analysis of e-pollbook adoption¹⁰.

¹⁰ <http://www.ncsl.org/research/elections-and-campaigns/electronic-pollbooks.aspx> (Retrieved 2017)

E-pollbooks and the voter registration database

Any pollbook is a temporary extension of the voter registration database (VRDB). Whether the pollbook is paper or electronic, voter records are extracted from the master database and made available in the polling place to identify voters and record their voting status for the current election. The ability to update the state voter registration database easily, using records from the polling place directly (rather than through a manual process) is one of the primary benefits of e-pollbooks.

Typically, records for the county are downloaded from the state voter registration database and the data converted to the appropriate format before loading onto the e-pollbooks. At the end of an election, the flow is reversed to update the state voter registration database (see Figure 12).

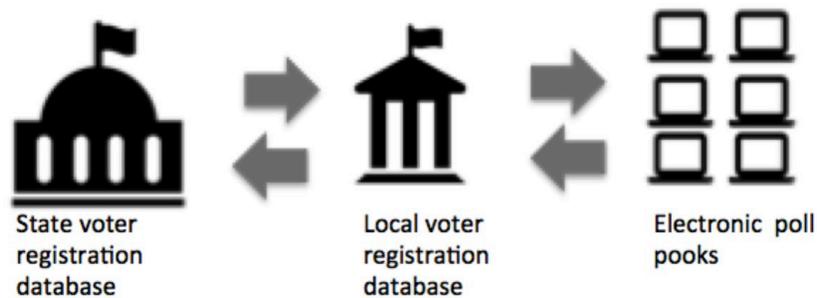


Figure 12. Voter registration data moves to and from the state voter registration database

Loading voter records on the e-pollbooks

Loading the voter registration database on the e-pollbooks is the core pre-election task, paired with receiving the voter records from them at the end of Election Day.

Technical options for data transfers

For all transfer methods requiring a network connection, both speed and reliability depend on the type of connection¹¹:

- Wired or wireless LAN are faster and more reliable.
- Mobile hotspots or cell phone connections are slower and less reliable.

All e-pollbook vendors offered more than one data transfer option to meet local election administration requirements (see Table 5).

¹¹ There are also security considerations, which are beyond the scope of this report.

Table 5. Methods of loading data onto the e-pollbook

Method	Examples	Considerations
Hardware	USB drive, SD card	Direct and fast, but requires manual action at each pollbook.
Peer-to-peer	Master device at each polling place	Local synchronization of pollbook data by loading the data on a single device which is used to synchronize the other local devices.
Portal	Device management system	Cloud-based system that manages synchronization across all devices.
Server	Internet connection to a server or directly to the central database	Device connects to a server to download or upload data.

Timing and administrative procedures

Several related factors influenced administrative procedures for how and when voter records are moved between the central database and the e-pollbooks.

The scope of the voter registration database on a single e-pollbook may be:

- A single precinct or polling place
- An entire county or local jurisdiction
- The entire state

For example, e-pollbooks loaded with voter records for an entire state can be used to identify the appropriate polling place elsewhere in the state where a voter is registered to vote. Additional considerations are shown in Table 6.

Table 6. Considerations for voter records loading procedures

Decision factor	Issues and variations
Relationship between the local and state database	Does the county maintain its own VRDB, or is it a local extension of the state records? Does the e-pollbook communicate with a local VRDB or work directly from the state VRDB?
Size and scope of the data loaded on the e-pollbooks	How large is the data file for each e-pollbook? The size of the data file affects speed and reliability of the transfer, and the network connection required.

Decision factor	Issues and variations
Passwords and system access at the polling place	<p>How do poll workers access the system?</p> <ul style="list-style-type: none"> • Individual passwords • Passwords for each polling place • How does the system identify the jurisdiction for which it can check in voters? • Through the poll worker password? • Something poll workers enter?
Internet connection at the polling place	<p>Are e-pollbooks required, allowed, or permitted to communicate with the election office?</p>
Network connection	<p>The type and bandwidth of the network connection may include:</p> <ul style="list-style-type: none"> • A hard-wired connection to an official government network (for example, a vote center in a clerk’s office). • A wired or wireless network at the polling place. • A mobile hotspot or modem.
Requirements for updates during the Election Day	<p>Election procedures may require:</p> <ul style="list-style-type: none"> • No updates during the day – all records are transferred after polls close. • Periodic updates for status checks or mid-day reporting requirements. • Constant updates (for example, in a vote center environment where voters can vote at any polling place).

Voter records are often loaded onto the e-pollbooks at the elections office before the election. If the election system is fully (and reliably) connected, it is also possible to load the data records onto the e-pollbook on the morning of the election.

Updating voter records during Election Day

The scope and process for data updates depends on the type of network connections available to the e-pollbooks.

When e-pollbooks have a network connection, voter records can be constantly updated during the day, so that all e-pollbooks have up-to-date information at all times.

If there is no external network connection, e-pollbooks may have a local network within the polling place, allowing multiple stations to serve a single polling place, whether a single voting district or a small collection of them. All of the commercial products we reviewed offered this option for jurisdictions where external network connections are not allowed (see Table 7).

Table 7. Data connection between e-pollbooks

Connection type	Data exchanged during Election Day	Impact of Election Director administrator
No connection	None	Updates entered manually.
Local network only	Local e-pollbooks synchronized	Polling place voter history updates shared locally. Manual updates can be entered on one e-pollbook per polling place.
Periodic connection	Periodic updates from the polling place (e-pollbooks → central)	E-pollbook updates (voter history, voter registration changes) sent to the central database.
Periodic connection	Periodic updates to the polling place (central → e-pollbooks)	Updates are sent to the e-pollbook, including missing records or updated voter information for specific voters.
Internet or VPN connection	E-pollbooks synchronized to central database	The entire voter database is synchronized between the e-pollbook and central database.

If Internet connectivity is allowed, the bandwidth of the connection can be an important consideration in how voter records are synchronized.

- E-pollbooks accessing the Internet wirelessly via a mobile hotspot will be restricted to mobile network data speeds.
- E-pollbooks using the building’s wireless connection may be sharing that wireless connection with other computers and wireless devices in the building.

E-pollbooks do not usually come with any special connectivity hardware, so local jurisdictions can make their own decision about the connection method best for them.

Election Day morning supplemental updates

Once at the polling place, pollbooks (both paper and electronic) are normally updated before voting begins. These supplemental updates collect last-minute changes to the voter history, such as whether someone has already voted or received a mail-in ballot and is not allowed to vote in the polling place. As with the initial loading of the data, the morning updates can be done in several ways (see Table 8).

Table 8. Methods of loading morning updates data onto the e-pollbook

Method	Description
Manual entry	In a procedure similar to paper, poll workers work from a list, manually updating the records.
USB drive, SD card	The updates are provided on a local drive delivered to the polling place.
Peer-to-peer	Local synchronization of pollbook data by from one of the pollbooks across a peer-to-peer network.
Download	Internet connection to a server or directly to the central database. Each device connects to a server to download or upload data.

Reports and monitoring during the day

With the ability to transfer information about voter turnout during the day, the election office can monitor the election more closely and provide updates to the public, press or campaigns. For example, Ohio requires mid-day reporting of the lists of people who have voted so far. With connected pollbooks, this information can be gathered and distributed from the election office instead of at each polling place.

Some e-pollbook products include operational dashboards as well, allowing election offices to check the status of the e-pollbook and voting at a precinct (see Section – Election day monitoring).

End of day reporting

End of day closing and reporting typically reverses the loading process using the same data transfer methods. Generated reports can be used for analysis and to improve election administration.

Although some commercial products come with a library of reports, others simply make the data available for use in standard data analysis programs.

E-pollbooks in the polling place

E-pollbooks have a breadth of features that impact their usability in polling places. The form factor and hardware itself, the access privileges afforded poll workers, and the monitoring capabilities of the central election office all impact their use.

Cases and form factor

There are several considerations about the form factor of e-pollbooks:

- A physical keyboard may make it was easier to type. The e-pollbook might have an integrated laptop keyboard, but could also have a keyboard case added to a tablet (at additional cost).
- E-pollbooks running the same operating system available in the county offices can be useful if IT staff are familiar with it.
- Tablet-based systems do not require separate devices such as mouse, signature pad or scanners, but use built-in functions instead.
- Laptop systems may require many wired connections (e.g., power cord, mouse, scanner, signature pad, printer). This setup may appear visually unorganized to voters if the cables are draped across the table facing the voter.

Many of the e-pollbooks reviewed come with custom cases designed to be an integral part of how they are used in an election.

- Some cases are also part of the system in use, for example, set up to act like a docking station, so poll workers only have to plug in a single power cord, with all other connections hidden in the case.
- Many have bright colors – green, red or yellow – so they are easily visible and not as likely to be lost in a corner or walk out the door.
- One system had a case that enclosed a small tablet that also served as both a stand or handle to hold the tablet while working the line.

Tablets often came with custom stands that served several purposes:

- Adjusted the angle of the screen to make the tablet easier to read, especially in a room with bright overhead lights;
- Provided a stylus holder (and attachment);
- Provided a location for voters to place an ID to be scanned; and
- Assisted the poll workers in turning the tablet to the voter for a signature.

Controlled access to e-pollbooks and functionality

The e-pollbooks use a variety of mechanisms for controlling access to the voter records and specific functions. Table 9 lists examples but is not exhaustive.

Table 9. Examples of e-pollbook access control mechanisms

Functionality	Examples of how handled
Login / connect	<ul style="list-style-type: none"> Individual poll workers identify themselves via password or other identity confirmation method such as an assigned string of numbers or grid cards. The chief poll worker logs into all of the e-pollbooks. There is a login for the polling place, rather than for an individual.
Access restrictions	<ul style="list-style-type: none"> Login/connection method activates correct precinct. Admin password required for certain functions such as ballot re-issue or clock override to change closing time.

Election day monitoring

All e-pollbooks provide some high-level views of polling place activity. Some examples are listed in Table 10.

Table 10. Examples of polling place activities via e-pollbooks

Functionality	Examples
Show polling place statistics	<ul style="list-style-type: none"> Number of voters handled per hour Number of voters checked in List of checked-in voters List of not checked-in voters Number of provisional ballots issued
Hardware status	<ul style="list-style-type: none"> Battery level Loss of power Internet connection
Visibility to election department	<ul style="list-style-type: none"> Central office can see polling places come on-line

Sources

The report of the Presidential Commission on Election Administration (PCEA), *The American Voting Experience*¹², helped put this work in a larger context.

To understand the legal landscape for e-pollbooks and where they were in use, we drew heavily on the National Conference of State Legislatures and research by Katy Owens Hubler on the use of e-pollbooks in states¹³.

We are enormously grateful to the e-pollbook companies who took time to show us their systems. We saw demonstrations of commercially available e-pollbooks at a “Demo Day” in Fairfax County and the 2015 NASED meeting in Washington DC.

We were also able to read reports on investigations into adopting e-pollbooks or pilots using them, as well as certification requirements from several states:

- Indiana Electronic PollBook Certification Test Protocol for the Voting System Technical Oversight Program
- Ohio Electronic Pollbook Requirements Matrix
- Pennsylvania EPB Test Protocol
- Virginia State Board of Elections, *Electronic Pollbook Certification*
- Minnesota Electronic Roster Task Force: *Legislative Report and Evaluation (2014) Findings and Recommendations (2015)*
- St. Louis, Missouri Biennial Report
- Wisconsin Government Accountability Board *Electronic PollBook Research Final Report*
- *Trading in the Paper: Nevada County’s Electronic PollBook Journey*

¹² The report is available on the PCEA website: <http://www.supportthevoter.gov/>

¹³ *Electronic Poll Books | E-Poll Books*, updated 5/11/2015 <http://www.ncsl.org/research/elections-and-campaigns/electronic-pollbooks.aspx>

Appendix

Table 11. Summary of hardware in e-pollbooks demonstrated

E-pollbook	Hardware platform	Scanner for ID Capture	Signature Capture	Case or stand	Other
Robis AskED Pollbook	<ul style="list-style-type: none"> Windows 8 Laptop or Tablet 	External	Onscreen or External	Custom case with docking station	On-demand ballot printing
VR Systems EVID	<ul style="list-style-type: none"> Windows Laptop or Tablet 	External	External		Mobile app for line management
ES&S ExpressPoll	<ul style="list-style-type: none"> Windows 8 Toshiba Tablet 	Camera	Onscreen	Custom Stand Keyboard	Interfaces to on-demand ballot printing
Votec VoteSafe	<ul style="list-style-type: none"> Windows 7, XP Laptop 	External	External		
ScytI/SOE Clarity ePollBook	<ul style="list-style-type: none"> Windows Laptop Android Tablet 	External Camera	External Onscreen		<ul style="list-style-type: none"> 508 certified iOS in process
Election Administrators EA Tablet System	<ul style="list-style-type: none"> Android Asus Tablet 	Camera	Onscreen	<ul style="list-style-type: none"> Custom case Stylus holder 	Mobile app for line management
EasyVote EasyPollbook	<ul style="list-style-type: none"> Windows Laptop 	External	External		
DemTech Voting Solutions Advocate	<ul style="list-style-type: none"> Windows iOS Tablet 	External	External	Keyboard	Admin. on Windows laptop
KnowINK PollPad	<ul style="list-style-type: none"> iOS Tablet (iPad) 	Camera	Onscreen	<ul style="list-style-type: none"> Custom stand ID holder 	

E-pollbook	Hardware platform	Scanner for ID Capture	Signature Capture	Case or stand	Other
Tenex Pollbook	iOS Tablet (iPad or iPad Mini)	Camera	Onscreen	Custom stand	
EveryoneCounts eLect	Custom Tablet	Camera	Onscreen	Custom stand	

Note 1: Most systems can provide a scanner for any driver's license, as needed in each state.

Note 2: All of the systems have an option for a small label printer.