



Blind and Low-Vision Voters

Case Study

2023

Background

One of the most important civil rights laws passed in our nation's history, the Americans with Disabilities Act (ADA) guarantees that the 61 million people with disabilities in the United States have equal access to public facilities, including voting. This requirement has been interpreted to provide a guarantee that all voters, regardless of ability, have the right to vote independently and privately, whether voting in person at a polling place or by absentee ballot. Current Census data estimates that there are approximately 38 million eligible voters with a disability, representing a nearly 20% increase since 2008, and meaning voters with disabilities now make up a larger share of the electorate than voters who are black (29.9 million) and Hispanic (31.3 million). And since nearly everyone will experience temporary or permanent disability at some point in their lives, this guarantee has the potential to benefit nearly every American.

Despite the federal guarantee in the ADA, voters with disabilities continue to face barriers to voting and are too often unable to exercise their right to vote. In the 2022 general election, for example, voters with disabilities voted at a 10% lower rate than voters without disabilities of the same age. Voters with disabilities were nearly four times as likely to report difficulties voting in person as voters without disabilities, and six times more likely to have difficulty voting by mail than voters without disabilities. Voters who are blind face particular barriers to voting and continue to be the most likely to face difficulties voting, with over 38% reporting difficulty voting by mail and over half reporting difficulty voting in person in 2022.

Mail voting can help address some accessibility barriers, but traditional mail voting is not accessible for all voters with disabilities, particularly voters who are blind or have a print disability and cannot independently handmark a paper ballot. Mobile voting would provide a fully accessible option that ensures any voter, regardless of ability, can complete the voting process entirely independently and privately, meeting the federal guarantees in the Americans with Disabilities Act.

Accessible Voting with VoteHub

The Free Democracy Foundation (FDF), with generous grant support from Tusk Philanthropies (TP), has supported the development of VoteHub, a new mobile voting system designed to not only provide a fully accessible absentee voting system for voters with disabilities, but to also mitigate the inherent security risks when casting ballots over the internet.

VoteHub is a native mobile voting application that is designed as a digital form of absentee voting. In this way, voters follow the same procedure used to cast a ballot by mail but on their mobile device. Here are the steps voters use to access and cast a ballot with VoteHub:

- Voters begin by providing identifying information, including their state and county/municipality, name, year of birth, and one additional identifier - either the last four digits of their social security number, their driver's license or state ID number, or their house number and zip code.
- VoteHub uses the identifying data to match a voter record in the county's eligible voter database. Voters must confirm their record is correct, including their address and email address.
- Voters then select whether they want to use digital or physical return. For voters using digital ballot return, they are prompted to retrieve a one-time access code from the email in their voter record and enter it into the app. This step provides the authorization to encrypt their ballot for digital return.
- Next, voters mark their ballot. They will be prompted with warnings if they skip a contest or do not vote for all available options. They also will be unable to vote for more options than the contest permits.
- Voters must then sign an absentee affidavit affirming their eligibility and identity. The app gives voters options to sign the affidavit, including using a finger or stylus, or, if unable to physically sign, by typing or speaking their name, uploading a photo of their signature, or making a mark. Those options may also require the voter to add a photo of acceptable identification or have a witness sign.
- Finally, the ballot and affidavit are separately encrypted and prepared for submission to a digital ballot box. Voters can submit their ballot immediately or first perform a check to ensure it is encrypted correctly before submitting.
- Once their ballot is submitted, voters receive a tracking code in the app and by email, which they can use to verify their ballot was received.

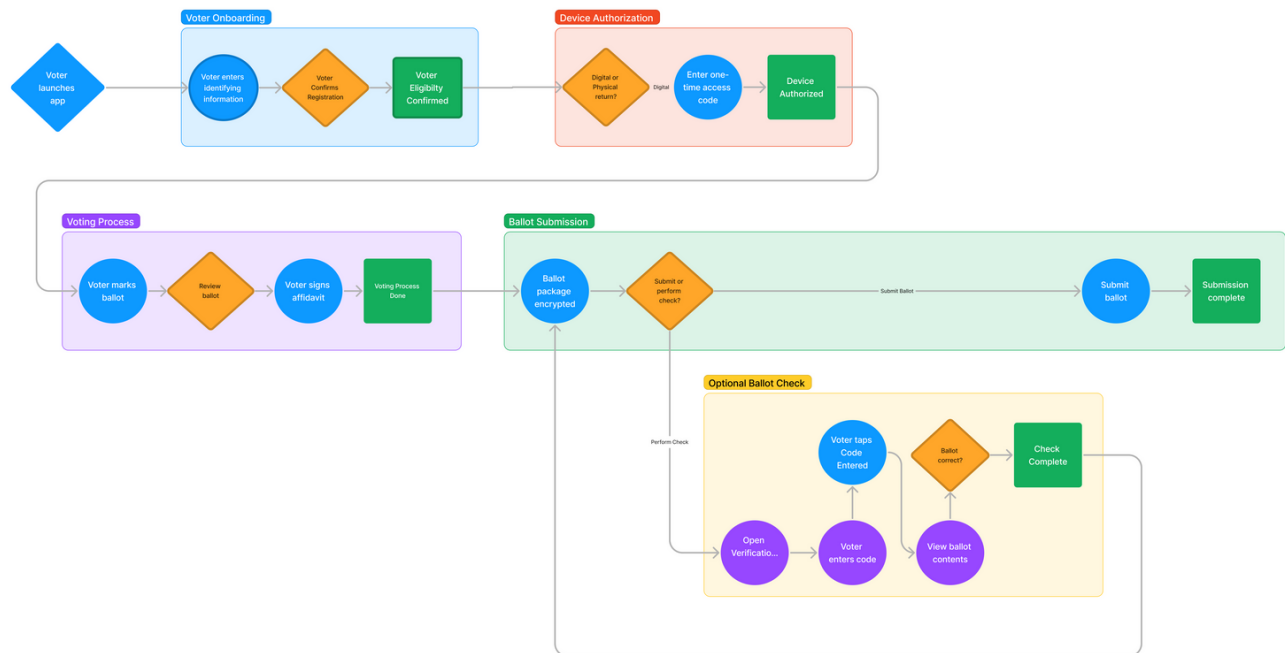
The ballot check process is a key security feature of VoteHub. This step enables voters to verify that their ballot is correct and that nothing has secretly changed any of their votes. To perform the check, voters must follow these steps:

- VoteHub displays the web URL for an external verification site. Voters are directed to open the site, ideally using a second device, such as a laptop or tablet.

- After entering the code into the verification site, voters are then directed to tap a button in VoteHub labeled "Code Entered."
- Both VoteHub and the verification site display a passkey. Voters are directed to indicate whether the passkeys match by selecting Yes or No in VoteHub.
- Once the passkey is confirmed, the verification site displays the decrypted ballot in plain text for voters to review.
- If everything looks correct, voters are directed to tap Yes in VoteHub, which then re-encrypts the ballot and prepares the package for submission again. Voters can choose to perform the check again - including as many times as they want - before submitting the ballot.
- If voters see any issue with the ballot during the check, they are prompted to answer No in VoteHub, which then directs them to use physical return.

The workflow diagram below displays the complete voting process for a voter using VoteHub:

Voter Workflow



Testing VoteHub with Blind and Low Vision Voters

To ensure VoteHub is fully accessible for blind and low vision users, FDF and TP collaborated with the National Federation of the Blind (NFB) to invite members of the NFB to participate in mock elections designed to mimic a real election pilot. Two mock elections were conducted, including one on August 1, 2023, and a second from December 5-11, 2023.

Users were invited to "register" to participate in the elections ahead of time. NFB contacted members by email in the weeks before with an invitation and a link to a Google form through which participants could register. Here is a sample of the email NFB sent to recruit participants:

Help Test Accessible Mobile Voting Technology

If you are looking forward to the day when you can vote using your smartphone, here is your opportunity to help make that desire a reality! [Tusk Philanthropies](#) is hosting a mock election on Tuesday, August 1st to test a new mobile voting app for iOS and Android devices designed to make accessible absentee voting more secure. Want to participate? Sign up at the link below by 5pm ET on Friday, July 28. Once you sign up, you'll receive instructions via email from mock election sponsor, Tusk Philanthropies, on how to install the app on your device and participate.

<https://forms.gle/xwu3psq5EYZ7yJEt5>



A total of 207 people signed up to participate in the August election and 165 signed up for the December election. Sixty-three people signed up to participate in both elections. The sign-up form asked users to provide their first and last name and email address. In the December election, participants also had the option to provide their mobile phone numbers if they wished to receive text alerts about the election. Of the 165 who signed up, 131 also provided phone numbers.

While the goal in both mock elections was to mimic as much as possible a real-world election, we opted to not use any personal data from participants. Instead, we provided users with "mock" registration information they could use to perform voter lookup and verify their registration. Each user was given the same data in instructions delivered by email on the day voting opened. This may have made the voter lookup process more complicated, particularly for users using voice over and other accessible technology, since it required voters to refer to an email to retrieve their assigned year of birth and social security number. In a real election, voters would know this information and likely not need to retrieve it from another source.

We used the same ballot for both elections, and all voters were presented with the same ballot content. The ballot contained three contests, including two candidate contests and one ballot measure. One of the candidate contests was a multi-candidate winner in which voters could vote for up to two candidates, while the other enabled voters to vote for one person. Both candidate contests included six candidates plus a write-in candidate option. See [Appendix C](#) for screen shots of the complete mock election ballot.

To install the VoteHub mobile app, users had different experiences between Android and iOS, and between the August and December elections. For iOS users, the mobile app was not available in the Apple app store in either election and could only be installed through TestFlight, Apple's service for beta testing applications. In August, users had to receive a separate email from TestFlight in order to install the app. In December, we used a public link to the TestFlight app, which made it much easier for users to install. Android users had an easier experience in both elections. The VoteHub app was available through the Google Play Store, and emails with instructions on how to participate included a link to install the app.

Voters received similar notices in both elections with instructions on how to vote. The email communication was designed to mimic the type of communication an election official may provide voters eligible to use mobile voting. The email included instructions (and links, when available) to install VoteHub, as well as their assigned "mock" voter registration information needed to use the app. The data included the last four digits of their mock social security number, driver's license number, and address. The email also contained a voting checklist and other helpful links to the verifier website to perform the ballot check and track their ballot (see a sample from December in [Appendix A](#)).

In the December election, voters also received a pre-election email one day before voting opened that contained instructions on how to install the app as well as helpful information about what to have ready when voting opened, such as access to their email, a second device to perform the verification (if available), and links to video demos showing how the app works. See [Appendix B](#) for a sample of this email. This email was sent based on feedback from the August election in which users indicated they would have preferred to know ahead of time what resources they needed to vote.

Also in December, voters who opted in received text messages notifying them when voting opened as well as a reminder text on the last day of the election. The text messages directed voters to check their email for instructions.

Results and Findings

August Results

For the August election, voting occurred on a single day, with the election opening at 8:00am ET, when voters received email notification, and closed at 7:00pm ET that evening. Over the course of the day, a total of 52 voters submitted ballots, or 25% of the voters who signed up.

During the election, we received a handful of reports by email from voters experiencing problems using the app. The biggest problem voters experienced was during ballot marking. The voting app requires voters to scroll through a complete list of candidates or ballot measure text before they can advance to the next contest, regardless of whether or not they have made the maximum number of selections. For voters using voice-over, this action requires a three-finger swipe gesture to scroll. However, many voters reported the gesture failed to activate the next button and they became stuck.

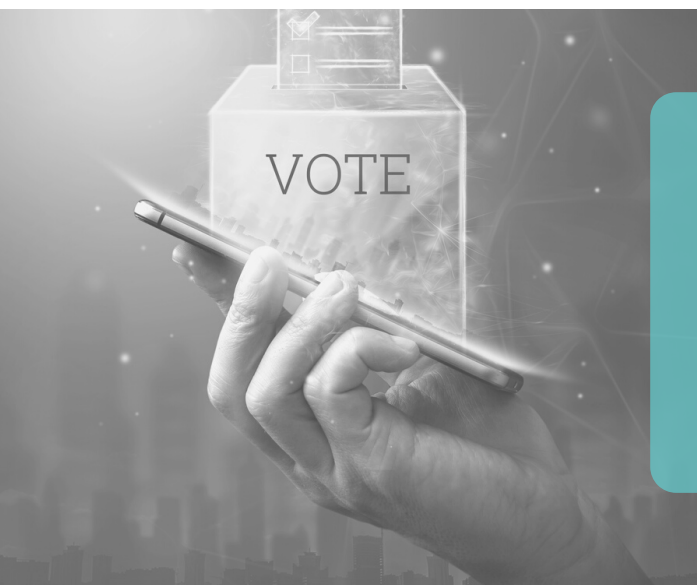
After investigating the issue, our developers discovered the swipe gesture would sometimes stop just above the bottom of the screen. They were able to fix the issue, and subsequent testing in December showed the improved usability.

Another issue reported over the course of the day involved communication from TestFlight through Apple's platform. Voters reported they never received a separate email from TestFlight inviting them to install VoteHub. We experienced this problem in other mock election tests with young voters. The use of a public TestFlight link in December resolved this problem.

December Results

For the December election, voting opened at 8:00am ET on Tuesday, December 5 and closed at 5:00pm ET on Monday, December 11. Over the course of the six days during which the election was open, a total of 63 voters submitted ballots, or 38% of the voters who signed up. We did find evidence that voters who signed up to receive text alerts about the election voted at a slightly higher rate (39%) than voters who did not (35%).

Overall, we received fewer reports of issues from users in the December election. The testing did reveal one issue related to an accessibility feature. Early on the first day of voting, we heard from several voters who reported being unable to activate the menu to choose their state and county. After investigating, including through a video call with one user, we discovered the problem was caused by an error in the app when users had turned on reduced motion in their accessibility settings. Voters were able to fix the issue by turning that feature off. Our developers also fixed the issue quickly and we released an updated app before the end of the first day.



62% Performed Ballot Check

92% Want to use mobile voting in future

Other Findings

One of the most impressive findings in the mock elections was the number of voters who successfully performed the optional ballot check. Seventy-two voters completed the check across the two elections. That's over 62 percent of the 115 who submitted ballots, including 32 of the 52 voters in August and 40 of the 63 voters in December. This figure is far above the average 43% we have seen in mock elections with other voting groups. And it is well beyond the minimum any security expert has suggested would be needed to be assured of the security of the ballots cast using VoteHub.

Survey feedback in both elections further reinforced our conclusion that the ballot check process was relatively easy for voters to complete. Voter responses in the surveys noted that it was very or somewhat easy, particularly when using a second device to perform the check. Several voters commented in the survey and in subsequent focus groups that the process would be easier if we provided a direct link to the verification site through the app, and if we enabled voters to copy and paste the checking code. The app was designed intentionally to not link directly to the verification site, in part to encourage the use of a second device and because a malicious attacker could misdirect voters to a corrupt verification site, nullifying the benefit of the check. Similarly, we have not enabled a copy and paste of the code again to encourage users to perform the check on a second device.

It is worth noting that we do not expect to see ballot check rates at these levels in public elections. Voters in these mock elections were aware they were testing new voting equipment, and consequently may have felt compelled to test every feature. Some users reminded us in focus groups that they are also highly skilled and experienced technology users and therefore may not be representative of the broader blind and low vision population. Further study in public elections with a broader set of users will be necessary in order to determine if we can maintain necessary levels of ballot verification to ensure the integrity of elections. But these early tests provide encouraging evidence that we have not only made the process usable for first-time young voters, but also for blind and low vision voters.

Complete survey feedback and findings are presented in [Appendix D](#).

Next Steps

Following these tests with blind and low vision users, Free Democracy Foundation's engineers and designers continue to make improvements to the user experience to enhance the accessibility and continue to improve the application. Several of the participants have offered to serve as beta users and provide continued retesting and feedback as we make further updates to the technology. Additional testing is also underway with voters with physical and cognitive disabilities in collaboration with the University of Colorado at Denver.

Free Democracy Foundation is also investigating opportunities to collaborate with digital identity service providers to explore alternative voter verification tools that could be offered in place of signatures. Given the signature process remains the source of the most friction for voters with vision impairment, we hope to collaborate with election officials, policy makers, and disability advocates to explore alternative strategies that will not only make VoteHub even more accessible, but will also provide stronger verification methods to ensure only eligible voters are able to vote.

About the National Federation of the Blind

The National Federation of the Blind (NFB) is a nonprofit, 501(c)(3) organization and is the largest consumer organization of blind people in the country. The NFB is committed to protecting the civil rights of the blind by, among other things, ensuring full participation of the blind in society, including the right of blind Americans to vote independently and privately. For more information about the National Federation of the Blind, visit <https://nfb.org/>.

About Tusk Philanthropies

Tusk Philanthropies is a nonprofit, nonpartisan organization seeking to expand access to mobile voting options in part by supporting efforts to develop and maintain secure technology for mobile voting. To learn more about Tusk Philanthropies' work to expand access to mobile voting, visit www.mobilevoting.org.

About the Free Democracy Foundation

The Free Democracy Foundation is a nonprofit, 501(c)(3) organization that supports technology solutions to ensure all eligible voters in the U.S. can participate in the democratic process. VoteHub is the first technology solution supported by the Free Democracy Foundation and is offered to U.S. election jurisdictions at little to no cost. For more information about VoteHub and the Free Democracy Foundation, visit www.freedemocracyfoundation.org.



VoteHub is owned and licensed from the Free Democracy Foundation.
Free Democracy is a nonprofit, 501(c)(3) organization.
www.freedemocracyfoundation.org
tech@freedemocracyfoundation.org

Appendix A – Email Invitation to Vote

[View this email in your browser](#)



Voting is now open!

Hello <<First Name>>,

You can now test vote using new mobile voting technology in the mock election hosted by NFB and Tusk Philanthropies! Remember to get your ballot in by 7pm ET on Thursday.

If you haven't already, you'll first need to install the VoteHub mobile voting app.

- For iOS users:
 - [Click this link](#) to install the TestFlight app on your device. (skip this if you already have TestFlight).
 - Once TestFlight is installed, [click this link](#) to install VoteHub on your iOS device.
- For Android users, [click this link](#) to install VoteHub on your Android device.

Once the app is installed and you're ready to vote, be sure to use the "mock" voter registration information below. We're not using your personal information in this mock election. Instead, you'll be able to look up your "mock" voter registration using the year of birth and identifying information shown below.

Questions or problems? Don't hesitate to contact us at tech@freedemocracyfoundation.org.

Your "Mock" Voter Registration:

State: **NFB**

First Name: <<**First Name**>>
Last Name: <<**Last Name**>>
Year of birth: **2004**
Last 4 of Social Security Number: **1234**
Driver's License #: **W98765**
Residential Address: **1 Main Street, Anytown, US 20001**
Email: <<Email Address>>

Voting Checklist

- Have your email application open and available while voting.
- Be sure to keep the “mock” voter registration information shown above ready when voting. You'll need it to access your ballot.
- Please select digital return when prompted. (You'll also have the option to use physical return, but we are not utilizing this feature for this mock election.)
- You may be prompted to add ID when signing your affidavit. You can take a photo or upload a document. For this election, you can just take a photo of anything (including a selfie, your pet, your wall, desk, hand, anything).
- Before you submit your ballot, be sure to [click here](#) to perform a ballot check and make sure everything is working correctly:
- Once you submit your ballot, [click here](#) to track it and confirm it was received.
- After voting, please take a few extra moments to [complete a survey](#) about your voting experience.

Questions or need help? Click below for additional information or contact us at tech@freedemocracyfoundation.org for assistance.

[VoteHub FAQs](#)

Thank you for participating in this Mock Election! Remember to get your vote in by
7:00pm ET on Thursday!

Mock Election Team
Tusk Philanthropies and Free Democracy Foundation



Copyright (C) 2023 Mobile Voting. All rights reserved.

Our mailing address is:

Want to change how you receive these emails?

You can [update your preferences](#) or [unsubscribe](#)

Appendix B – Voting Opens Tomorrow Email

[View this email in your browser](#)



Voting is will open soon!

Hello <<First Name>>,

Thank you so much for signing up to participate in our mock election with NFB to test new mobile voting technology designed to make voting more accessible and secure. **Voting will open tomorrow, December 5 at 8:00am ET and will be open until 7:00pm ET on Thursday, December 7.**

When voting opens tomorrow, you'll receive an email with information about how to vote, including mock voter registration information to use. Before the election opens, we wanted give you a quick checklist of items to have ready when voting opens and you're ready to begin.

First, you'll need to install the VoteHub app on your mobile device.

- For iOS users:
 - [Click this link](#) to install the TestFlight app on your device. (skip this if you already have TestFlight).
 - Once TestFlight is installed, [click this link](#) to install VoteHub on your iOS device.
- For Android users, [click this link](#) to install VoteHub on your Android device.

Second, when you're ready to start voting, be sure you have ready access to your email. You'll need the "mock" voter registration information we'll send you tomorrow. And you'll need to access your email for a one-time access code to be authorized to vote a digital ballot.

you don't need to take a photo of any ID. You can just take a photo of yourself, your pet, your wall, desk, etc. Anything works for this test. We just want to collect your feedback on how the process works and if there are problems with accessibility.

Finally, you may also want to have a second device available when voting, such as a laptop or tablet. You'll use a second device if you choose to perform an optional ballot check when voting. This is optional, and if you don't have another device, you can also perform the check on your phone. You'll need access to the web browser.

If you'd like to learn more about how VoteHub works, [click here](#) for some background and even video demos.

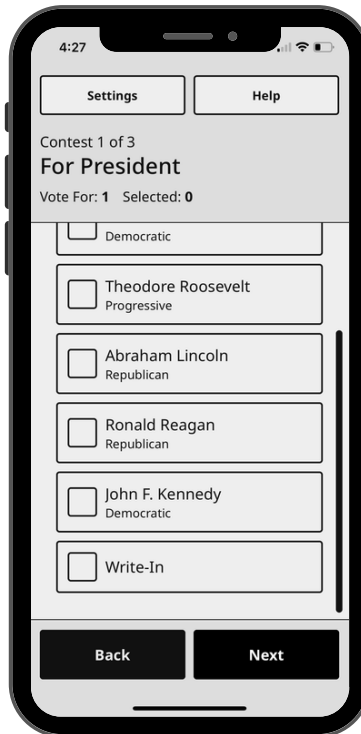
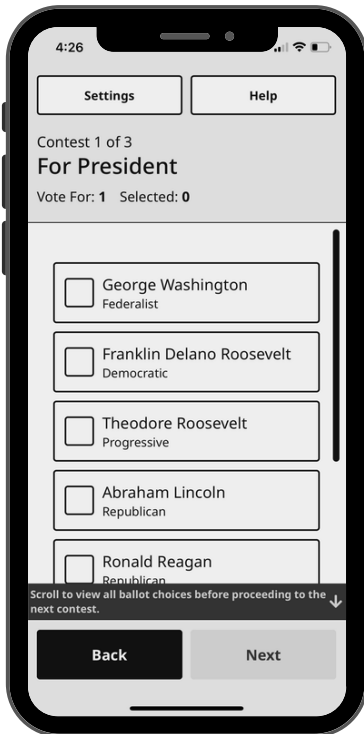
Want to learn more about mobile voting and how to bring technology like this to your state or county? Contact us at info@mobilevoting.org.

Thank you for participating in this Test Election! Look for an email tomorrow morning with final instructions.

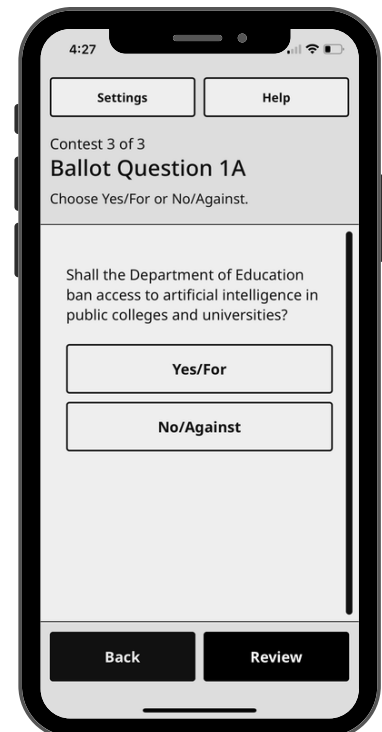
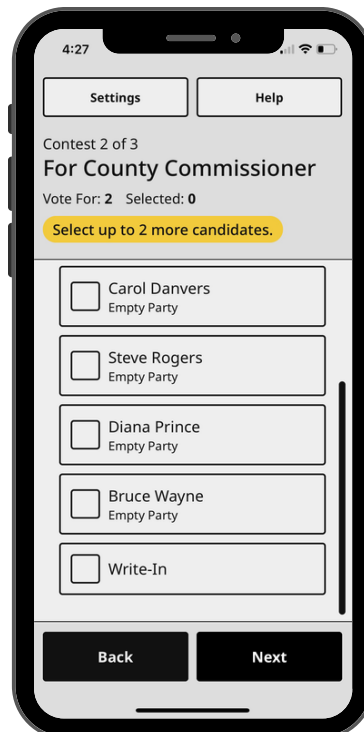
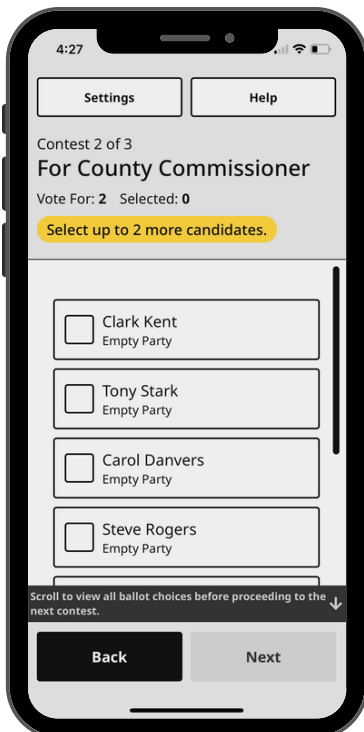
Mobile Voting Team
Tusk Philanthropies and Free Democracy Foundation



Appendix C: Ballot Screen Shots



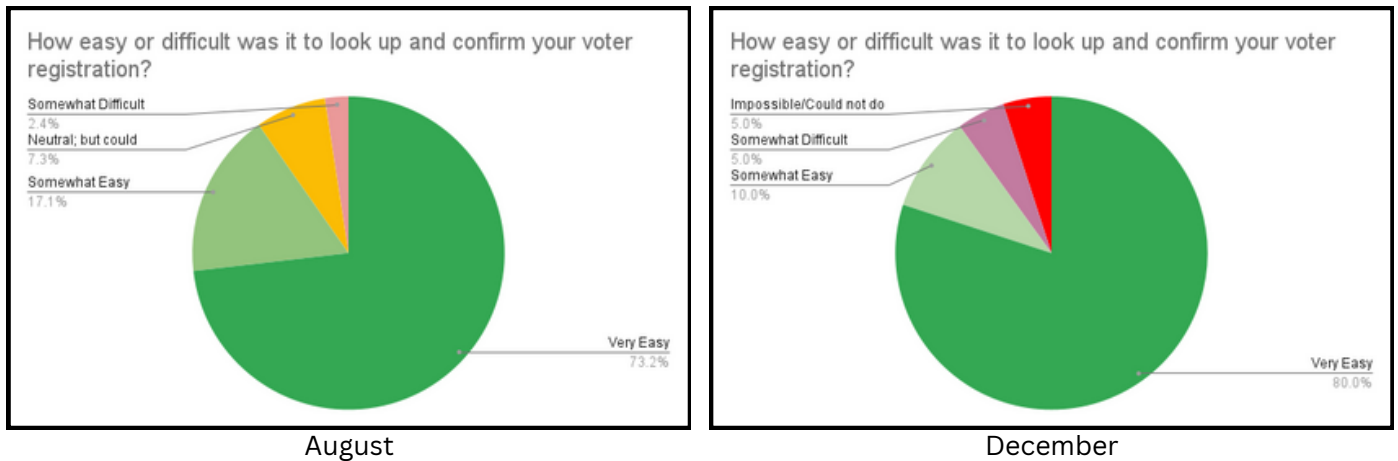
Screenshots of the ballot content used in both the August and December mock elections, including the two candidate contests and ballot measure.



Appendix D: Survey Results

Survey data from both August and December elections are presented below. Unless otherwise noted, graphs on the left represent data collected in the August election; graphs on the right represent data collected in the December election.

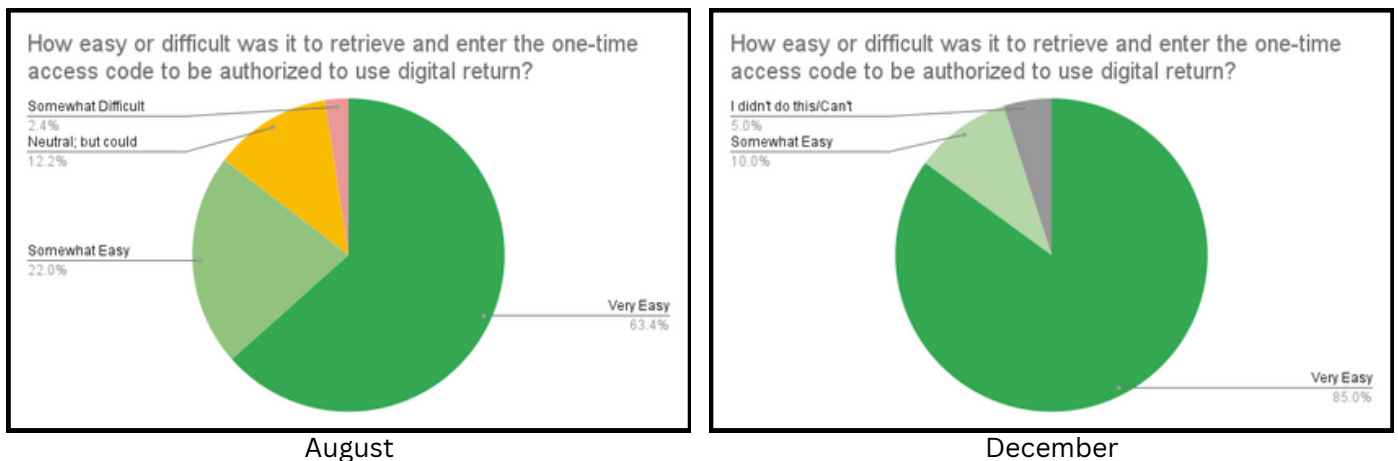
Voter Look Up and Registration Confirmation



Overall, most voters found the look up process easy, particularly in the December election. One voter noted, "This step of the process was particularly smooth and should definitely be acknowledged as being both accessible and usable by people with disabilities." Another commented, "This was really fast and accessible. I'm very impressed!"

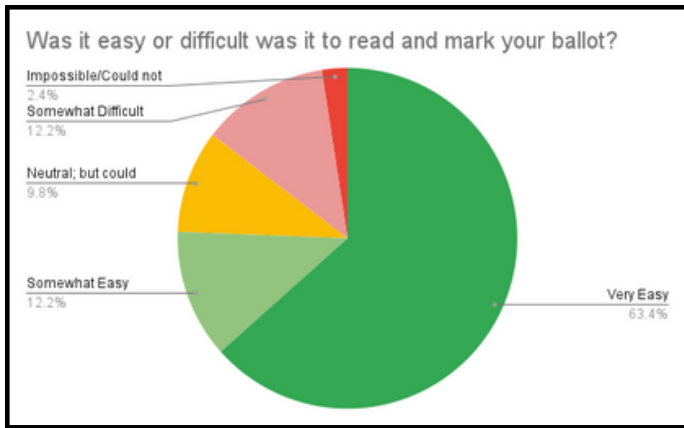
Several users noted that the process could be improved by removing the need for users to press a "Select" button on the Select Your State and County pop-up menu. Instead, they recommend the selection from the menu options be enough to close the menu. This would be a particular improvement for voice-over users. Our engineers are working to fix this before any public election pilot.

One-Time Access Code Process

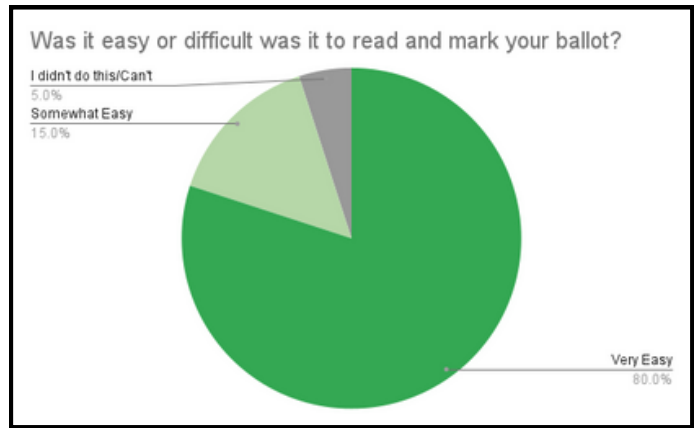


Several voters reported that the access code was delivered to a spam folder, which made it more difficult to find and retrieve. Others asked for an SMS option to receive the code.

Ballot Marking Process



August

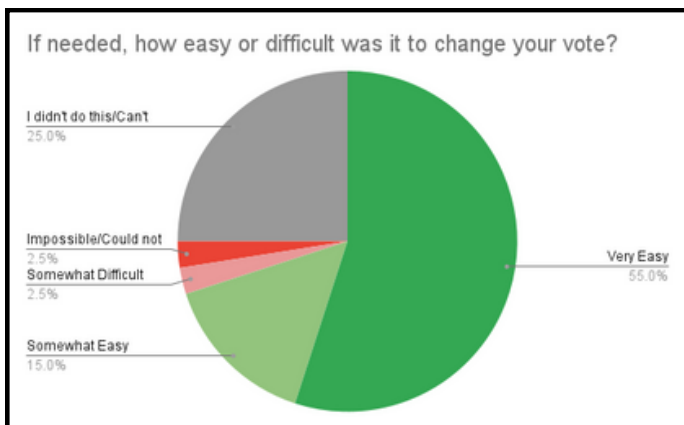


December

The main source of friction in the August election involved the scrolling gesture that was not working. Otherwise, voters reported making selections was easy. The write-in process also worked for voters who used it, but some reported it was somewhat clumsy.

December survey results show the fix implemented by our engineers to the scrolling issue was successful. No voter reported any difficulty marking their ballot. One respondent commented, "The process was easy. I missed the part where we had two choices in the second screen but the app nicely reminded me when I went to submit."

Ballot Review / Change Vote Process



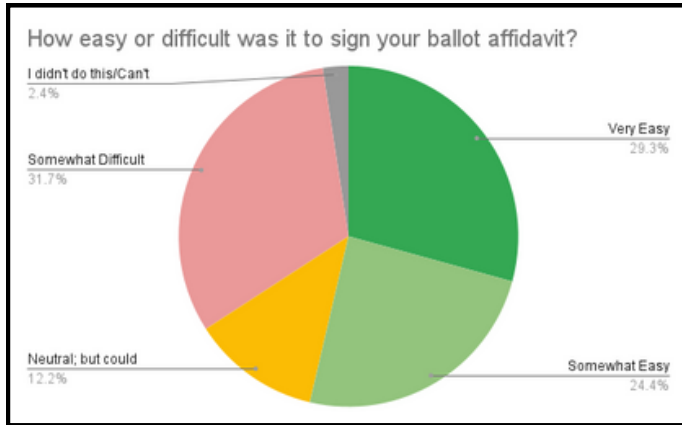
August



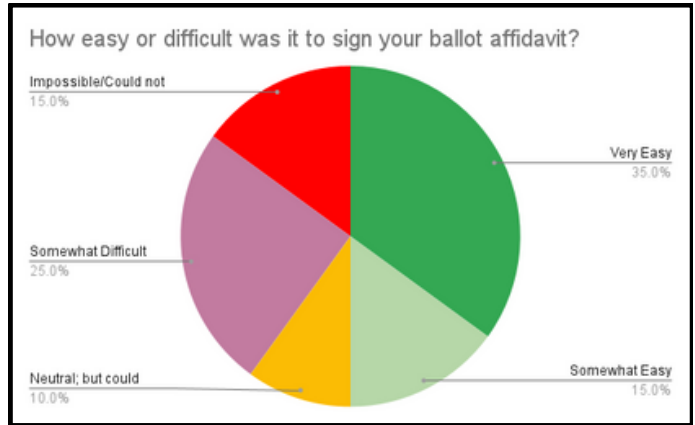
December

No specific comments were provided.

Affidavit Signing Process



August

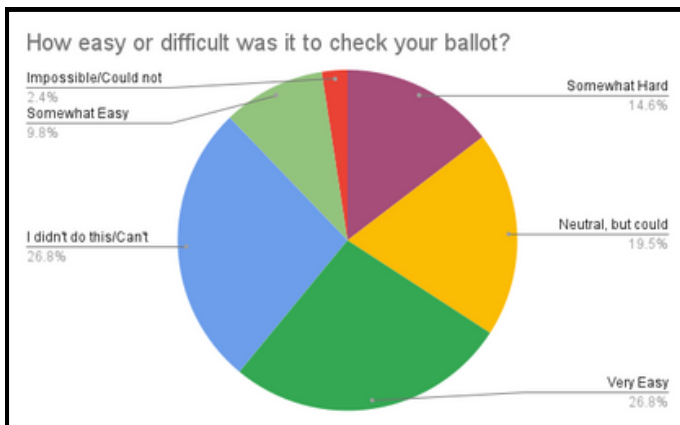


December

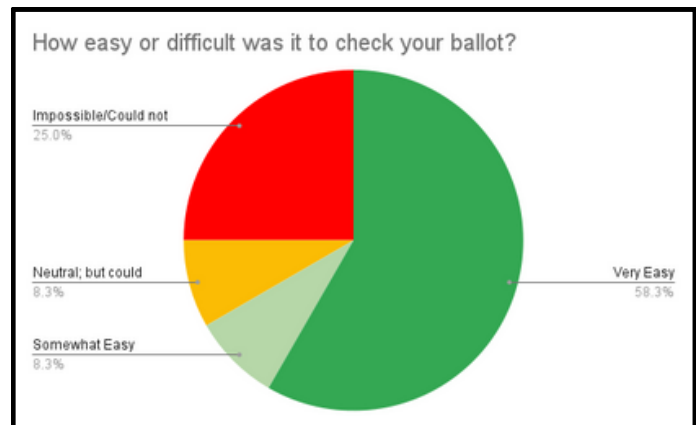
Completing the signature affidavit step caused a significant amount of friction based on user feedback. Voters who opted to use their finger to sign reported difficulty knowing where to put their signature. It requires them to turn off voice over, which made it impossible for blind users to locate the signing field. Others had difficulty because the app did not detect that they had signed. Some voters who chose to use the type/speak name option reported frustration over the ID requirement. They were not prepared with an ID ready and did not want to share personal information. No voter reported difficulties with the mark to sign option.

Ballot Checking Process

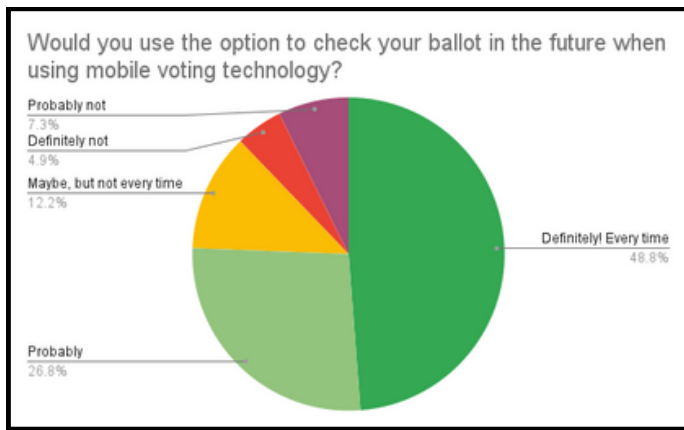
In the December election, we collected separate feedback from users regarding the ballot check. We asked if users performed the check and if they used a second device, before asking how easy or difficult the check was and if they would use it in the future. Among the users who performed the check, more than half used a second device, and nearly 70% found the process very or somewhat easy. Regardless of how easy or difficult the process was, a large majority (around 75%) indicated they would use the check in future elections.



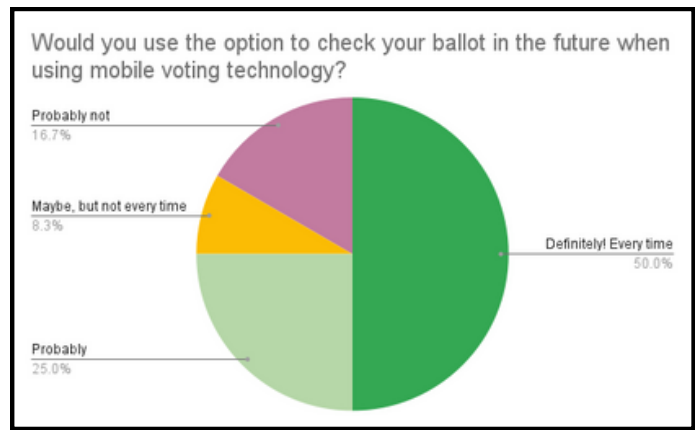
August



December

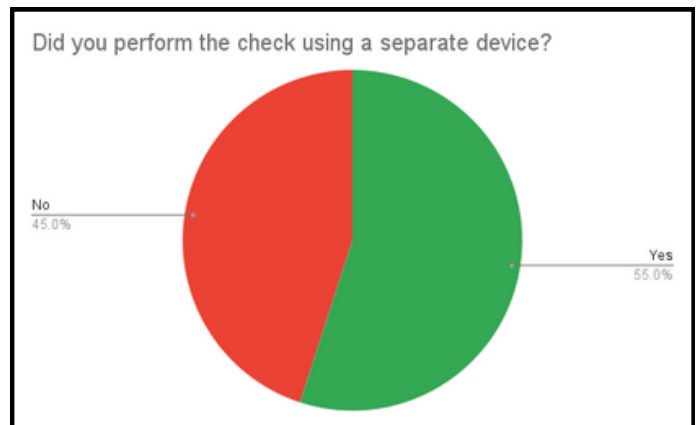
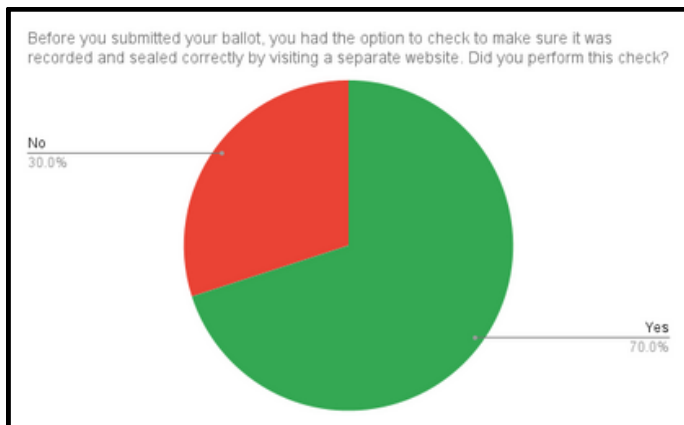


August

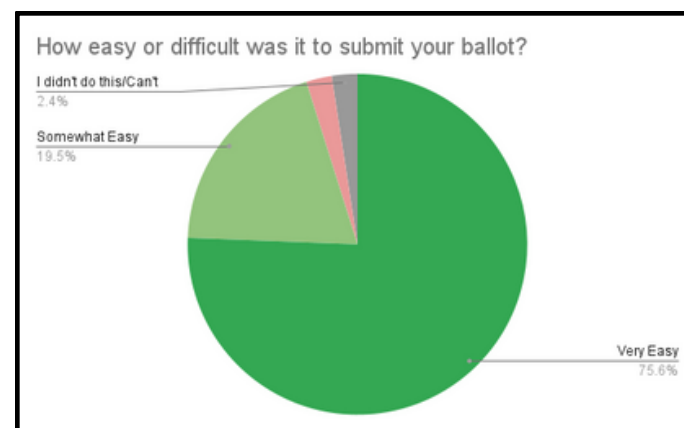


December

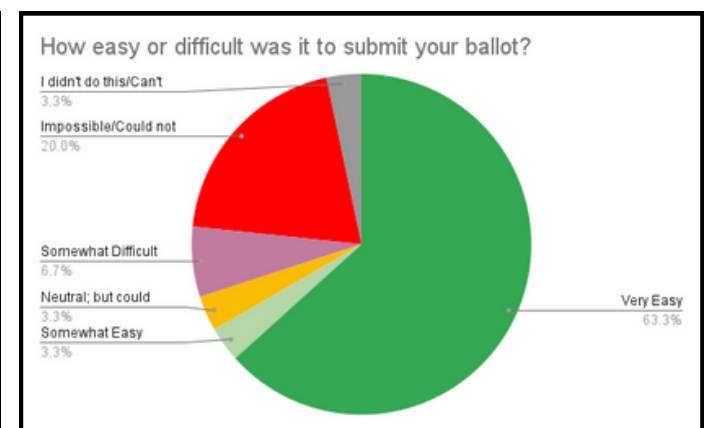
The following graphs represent data collected in the December election. The questions were not included in the August survey.



Ballot Submission Process



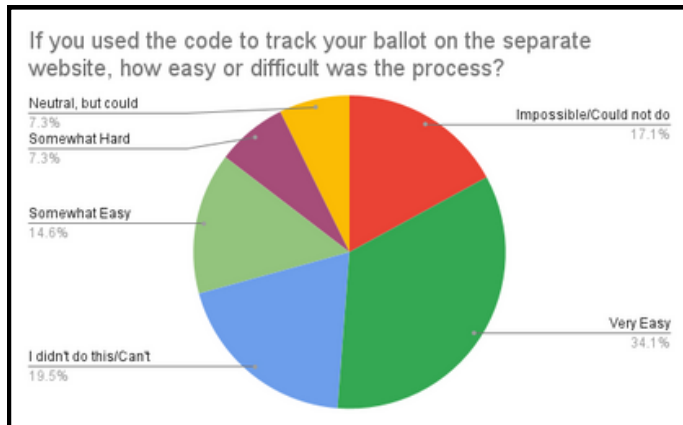
August



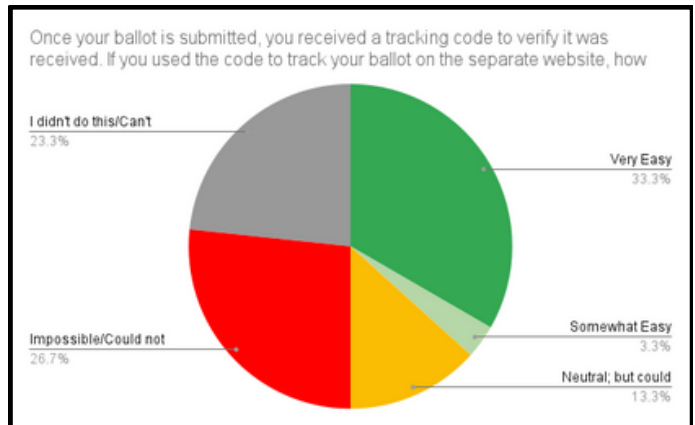
December

Voters in August reported this process was smooth and easy with no negative feedback. In December, some users reported the app did not respond when they pressed the submit ballot button. We're conducting additional supervised user testing to investigate possible causes.

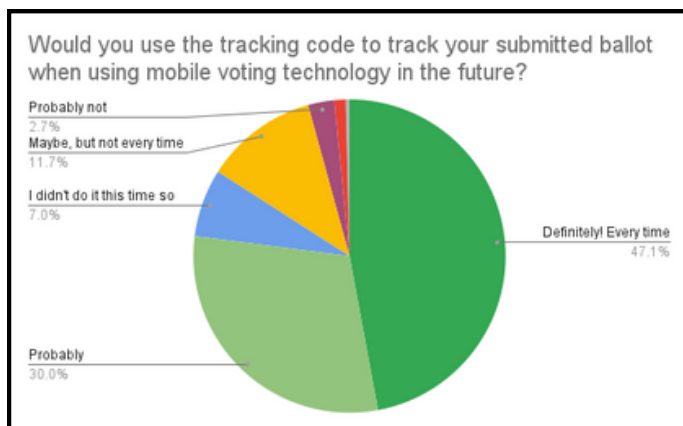
Ballot Tracking Process



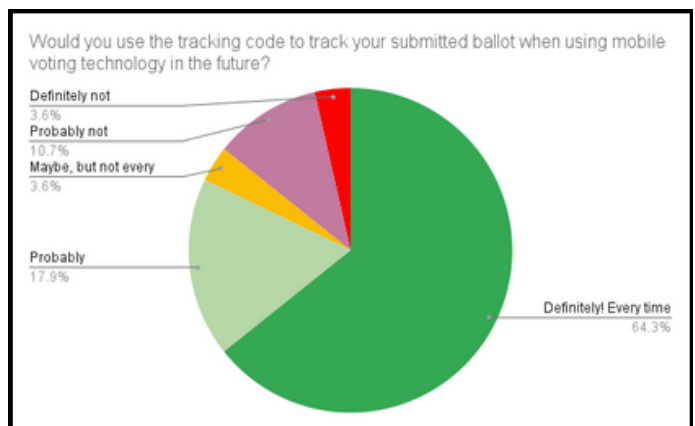
August



December



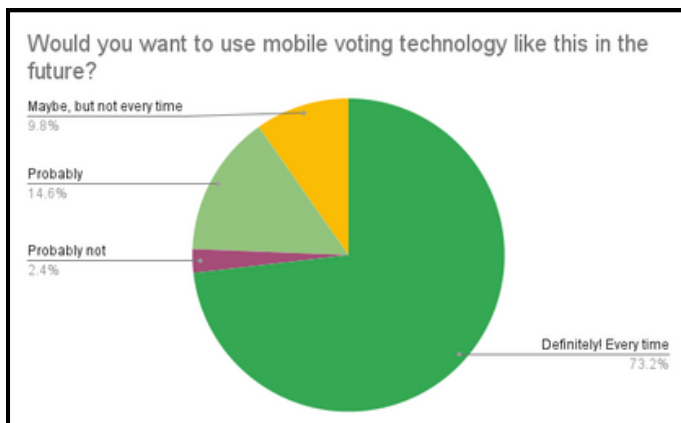
August



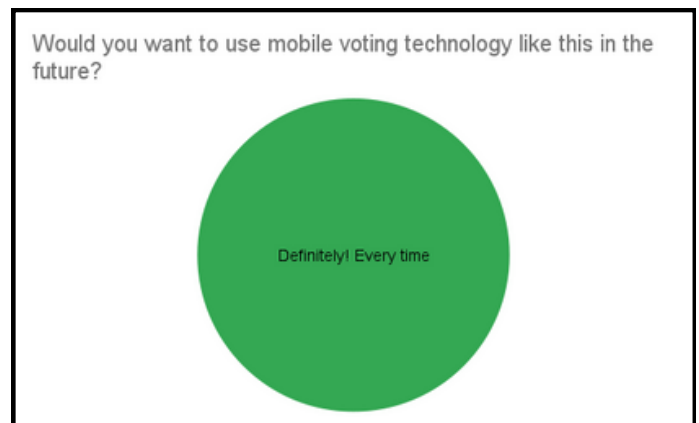
December

The biggest source of confusion in ballot tracking concerned the email confirmation. At the time of the August election, the email had not yet been implemented so voters did not receive an email with their tracking code. In December, voters received the emailed code, but it did not include a direct link to the verification site, so some users still reported confusion and difficulty. This functionality has now been implemented and we anticipate improved usability findings in the future. A majority of users indicated they would also use the ballot tracking feature in the future.

Overall Feedback



August



December

Here are the final comments provided by respondents:

- Overall, I found the experience to be very accessible. I am excited about the potential of this app for future voting. It would be great to be able to vote entirely independently without having to go to a polling place, and to be able to use technology with which I am already familiar. (Often times, the people at the polling places do not know how to set up the accessible voting equipment properly, so it would be great to not have to deal with that, and to not have to deal with trying to find transportation.)
- This makes me think we are on the road to obtaining online accessible voting.
- I think this would be a great way to vote. It's very convenient and I don't see any reason why it could not be made totally secure. I would definitely use this technology if it were available.
- Testers should be compensated for their time as this will take several more attempts to get this right.
- I think the idea here is a very good one. That said, I thought the IOS app was terrible. It got stuck, and that was very frustrating. The android app was better though, because it worked properly the first time out.
- Thanks for letting me be a part of this study.
- I found this experience interesting.
- I would hope that the app, and its associated software would not be easy to hack. I would also hope, that enough confidence is built into the people who use the app that we don't develop fake conspiracy theories.
- I like the app, but it is still nice to vote in person.
- Overall, this technology looks very promising and I am excited to have it more widely available. Thank you for doing so much testing ahead of time so that voting in actual elections can go smoothly for everyone.
- Great job with this technology and experience. Thank you.
- I really like this option. I hope that not only can we ensure security but we can also ensure a person votes in an election even if there is an error or hiccup within the technology.
- I can't wait until I can vote this way. Thank you.
- I look forward to having the opportunity to test the app & to using it in an actual election.
- Enjoyed the experience.
- I loved using the app, and I hope that it becomes standard very quickly. Please see one of the first text boxes in this survey I explain everything.
- Keep up the good work. When I followed the directions to the letter it worked. Hopefully the final app will be able to be forgiving of errors and multiple back and forth before the final submission.
- I love being independent without any help. It was not clear if I could start and finish later. That may become necessary especially on mobile, incoming phone call, transportation stop, meal ready, etc.
- I am pretty ignorant about cyber security, and would want to learn more about how my vote is accurately received and processed and counted so that I could trust my vote is counted without being tampered with.
- I hope this can work in the future.
- It is difficult to hear things in a polling place so this is great.
- I just want to thank you for the opportunity to test this app out as it goes through. It's changes to make voting more accessible for people with disabilities such as, but not limited to visual impairment.