



# Voting with wallets

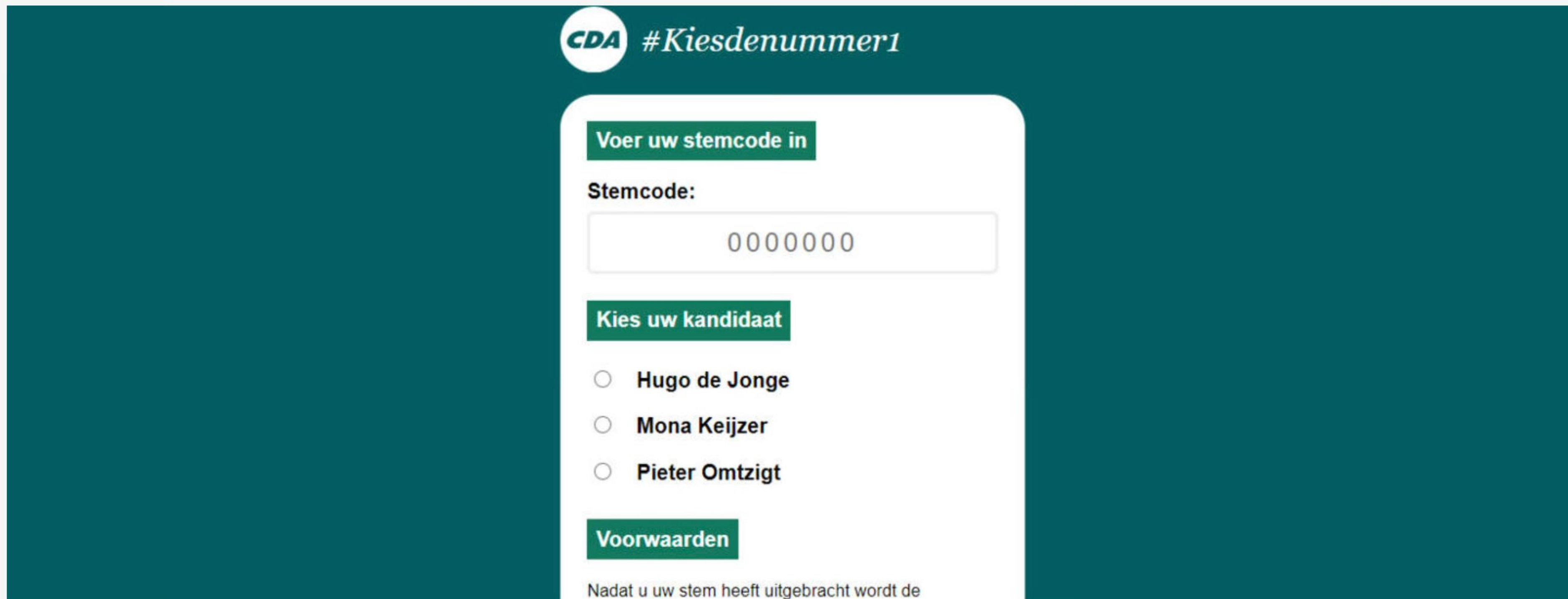
Using Yivi for online decision making

SCIENCE

# TPM PhD student hacks CDA voting page

CDA members who voted for a new party leader will have to vote again after TPM PhD student Jordy San José Sanchez exposed a leak in the political party's voting webpage.

SASKIA BONGER 10 JULY 2020 8:09



# What is needed

## Better solutions for online decision making

- Open source
- Secure (whatever that means)
- Usable
- Accessible

# Open source platforms

## Existing solutions

Helios Voting Booth [exit](#)

### Paisley goran zachary

(1) Select (2) Review (3) Submit

#### Your audited ballot

**IMPORTANT:** this ballot, now that it has been audited, *will not be tallied*.  
To cast a ballot, you must click the "Back to Voting" button below, re-encrypt it, and choose "cast" instead of "audit."

**Why?** Helios prevents you from auditing and casting the same ballot to provide you with some protection against coercion.

**Now what?** [Select your ballot audit info](#), copy it to your clipboard, then use the [ballot verifier](#) to verify it.  
Once you're satisfied, click the "back to voting" button to re-encrypt and cast your ballot.

```
{ "answers": [ { "choices": [ { "alpha": "5340426416524709635079966493084707282681902047826300939055317360386883898749322341985706612306195072583581805382639614483224919204959589827621194587796773135557754548922579257131906848206716766447437343865407667620853125166587854105836266029418089512671092389445508884162908413264208300416538725287892500658802989306489016429676816227862083079443918824380378583656587854159230681957607081566442247744952685866944579311336353621268304654226286525776252542741009498858100808482986104560824055463863068265266519883371067514102586949071635025017708175982436280839731021220619814907841035491852476918242111466124731347163", "beta": "115204256453069265418729900615817796802563845366552810898072723658866534346375" } ] } ] }
```

Before going back to voting, you can post this audited ballot to the Helios tracking center so that others might double-check the verification of this ballot.

**Even if you post your audited ballot, you must go back to voting and choose "cast" if you want your vote to count.**

[back to voting](#) [post audited ballot to tracking center](#)

Belenios admin interface Election Design Iepstraat

vote.belenios.org/v3/election#vgtGGz21mnMKYA

BELENIOS Election Design Iepstraat

Language: English [\(Wish to help with translations?\)](#)

[Start](#)

[See accepted ballots](#)

#### About this election

Election identifier	vgtGGz21mnMKYA
Election fingerprint	<a href="#">etE8aZEgN980kcF100+1bKZ3Mir0LNLZJyU1np2SFM</a>
Administrator	floris
Number of voters	2
Voter list fingerprint	0U8qDTmeXLUaENzqjKJTVn4x1JTM0S6No2ivVCNjSD8
All of the following trustees (verification keys) are needed to decrypt the result:	<ul style="list-style-type: none"><li>server (xEH4CZDgt6cBvFB4p05IzcZhkqk1r0mJT21ZHhy0DF0)</li><li>Floris fm (E700t8vLo7b0WVJqt914lqghtjT8fCCFInUGs/Kn7Ds)</li></ul>
Credentials authority	server
Credentials fingerprint	<a href="#">06K2jEtizU9ao1ikgDic0beeYz51Bx5D56JgtUe2y0g</a>

Audit data: parameters, public data. Advanced mode. Administer this election.  
Powered by Belenios 3.1-dev (3.1-255-g37093641). [Get the source code](#). [Terms of service](#).

By using this site, you accept our [terms of service](#). [Close](#)

# Open source platforms

## Problems with existing solutions

- Usability and accessibility issues
- Complex verification of vote
- Email-based eligibility proofs

# Open source platforms

## Problems with existing solutions

- Usability and accessibility issues
- Complex verification of vote
- Email-based eligibility proofs

➡ We can overcome these with **wallet-based voting!**

# Wallet-based voting

## A better solution for online decision making

Server A

1. Prove voting eligibility with **identity wallet**
2. Save voting card with anonymous voting number in **identity wallet**

Server B

3. Fill in the ballot
4. Cast ballot, sign with voting number from the **identity wallet**

Server C

5. Optionally, view results
6. Optionally, check vote has been counted with **identity wallet**

# Wallet-based voting

## IRMA Vote (2020)

The screenshot shows the IRMA Vote web application interface. At the top, a dark red header contains the text "Raadplegingen met IRMA" next to a small IRMA logo. Below the header, a light gray box contains the text "Keuze uitbrengen is mogelijk tot **maandag 12 januari 2026**." The main content area is split into two columns. The left column features a satellite map of a city on the left and a poll question "Wat is uw mening over sneeuw?" on the right. Below the question, there is a sub-instruction "U kunt nu stemmen. Selecteer de gewenste optie, en kies bevestig." and three radio button options: "Geweldig", "Afschuwelijk", and "Geen mening". A blue "bevestig" button is positioned to the right of the options. The right column has a light blue background with the text "Ga verder met **yivi**" at the top, where "yivi" is a stylized logo. Below this, a white box contains the instruction "Selecteer eerst een stemoptie in het linker scherm, en druk op 'bevestig'." At the bottom of the interface, two blue buttons are connected by a horizontal line: "Identificeren & Stemkaart ophalen" on the left and "Stem uitbrengen" on the right.

# Wallet-based voting

## IRMA Vote (2020)

- Technical proof of concept
- Not all parts were built

# Wallet-based voting

## IRMA Vote (2020)

- Technical proof of concept
- Not all parts were built
- ➔ Our new **Decidos** voting platform revives this project
- ➔ Focus on **usability, accessibility** and **user experience design**
- ➔ Intended for **small-scale elections**, e.g.,:
  - local consultations
  - representatives in organisations
  - stakeholder decisions

# Decidos



## Election Design Iepstraat

What do you want to happen with the existing parking spaces?

### Voting takes four steps

1. [Get your voting card](#)

Prove that you may vote and get a voting card in

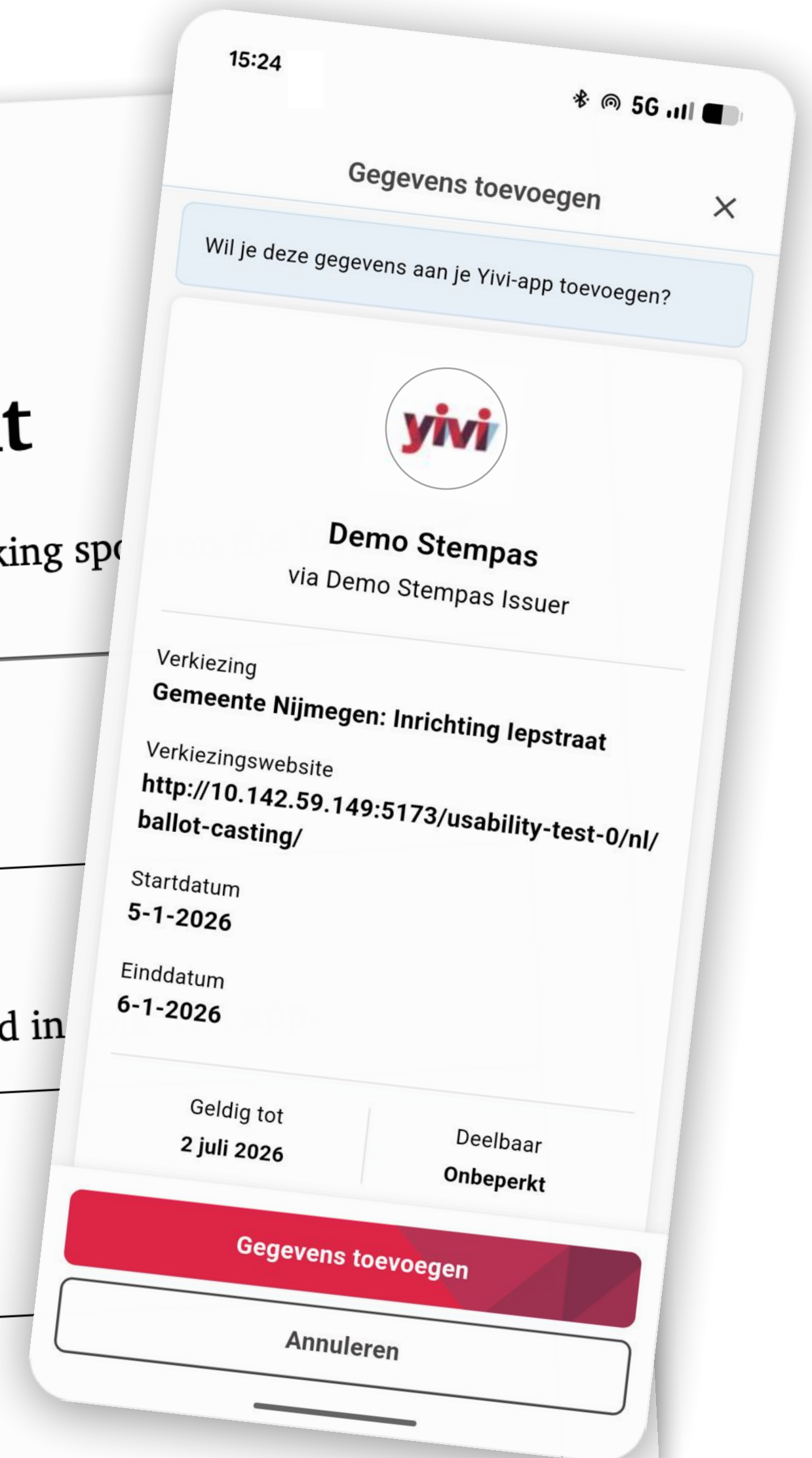
2. [Fill in your ballot](#)

Make a choice and fill it in on the ballot.

3. **Cast your ballot**

Hand in your voting card and ballot, together.

4. **View the outcome**



**Decidos demo**

**Decidos election**



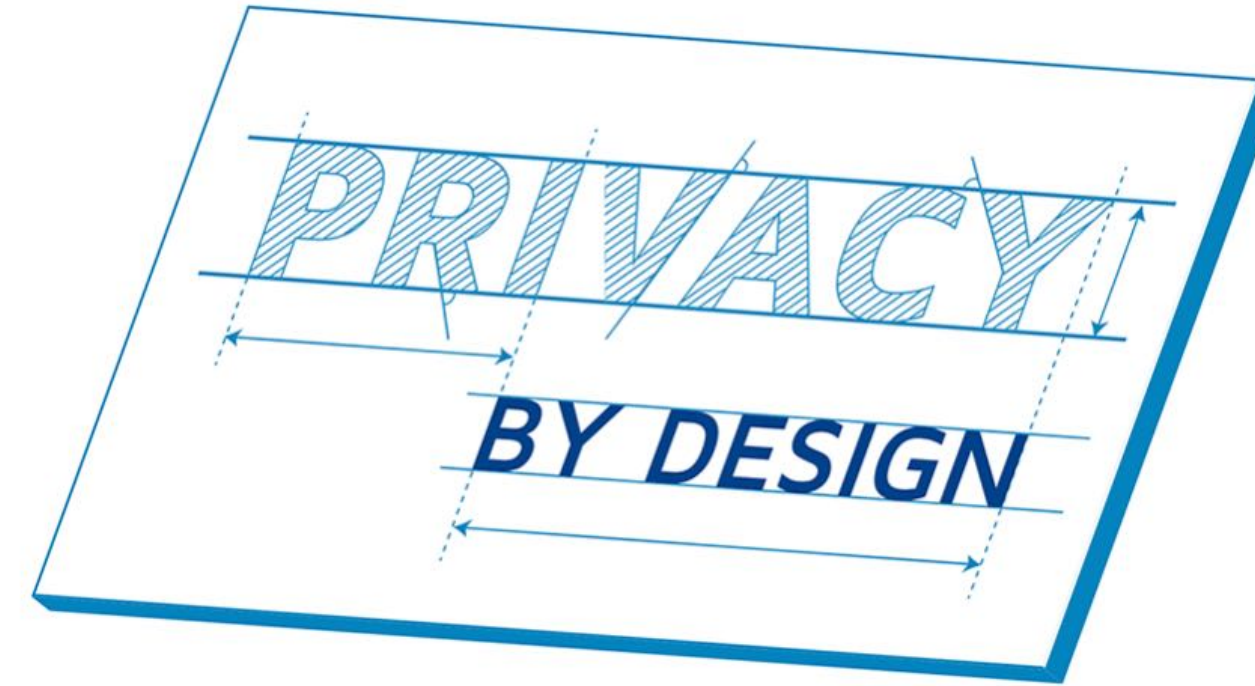
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Privacy policy  

The Privacy by Design Foundation aims, in a general sense, to support the development and the use of open, privacy-friendly and secure digital technology, with a user-centered focus.

At this moment the foundation focuses on the **Yivi app**, a wallet for digital identity, and on **PubHubs**, a community platform for safe online contact. The foundation owns the brand rights of Yivi and PubHubs. The foundation does have employees, but it cooperates with other parties to maintain and further develop Yivi and PubHubs so that they can be used widely.



## The board of the foundation

- **chair Bart Jacobs** (b.jacobs 'at' privacybydesign.foundation) is a professor of security, privacy & identity at Radboud University. Hij works with his research group on many societally relevant security and privacy topics and is often involved in societal discussions about digitalisation.
- **Secretary Monique Hennekes** is a judge at the court of appeal of Arnhem-Leeuwarden. Before that, Monique was an attorney-at-law, specialised in privacy and IT law. Monique helps the Privacy by Design foundation with the legal aspects regarding Yivi.
- **Treasurer Jean Popma** (j.popma 'at' privacybydesign.foundation) has ample experience as former project manager Applied Security Research at Radboud University Nijmegen and as Security Officer within Radboud University.
- **Martijn van der Linden** is teamleader citizen contact of the municipality Meierijstad. Earlier he worked for the city of Nijmegen where he was closely involved with the pioneering Yivi (at the time: IRMA) developments there.
- **Peter Eikelboom** is product owner of the eduwallet at SURF/Npuls. His team investigates what a wallet with a digital identity and credentials can mean for education (and the labour market) Earlier, Peter worked at SIDN, where he was closely involved with the Yivi developments there.



▶ Step 2 of 4

### Fill in your ballot

#### Does the PbdF need a new chair?

- No, Bart Jacobs is great!
- Yes, and it should be Arnout Terpstra.
- Yes, and it should be Hanna Schraffenberger.
- Yes, and it should be Hugo de Jonge.

[Continue to casting vote](#)

**Decidos design**

# Decidos design

**Eligibility to vote is defined via attributes.**



## Email address

by Yivi

Email address  
**hanna.schraffenberger@ru.nl**

Email domain name  
**ru.nl**



## Demo Address

by Demo Municipality

House number  
**15-3**

Postal code  
**6522JW**



## Education and research

by Privacy by Design Foundation

Institution  
**ru.nl**

Type  
**employee**

Registration number  
**25878566**



## YiviTube membership

by Privacy by Design Foundation


Type  
**regular**

ID  
**54258785666**

# Decidos design

**Voting process mimics well-known physical elections.**

The screenshot shows a mobile application interface for the Election Student Council. At the top, it displays the 'Electo University' logo and the title 'Election Student Council'. Below this, a progress indicator shows 'Step 1 of 4'. The main heading is 'Get your voting card'. The text explains that users need to prove they study at Electo University through the Yivi app to receive an anonymous voting card. A central box contains the instruction 'Get your voting card using yivi' and two buttons: 'Open Yivi app' and 'Show QR code'. A link 'What is Yivi?' is located below this box. At the bottom, there is a link to 'Wissel naar het Nederlands'.

Electo University  Election Student Council

▶ Step 1 of 4

## Get your voting card

For this election, you need to prove you study at Electo University. You do this through the Yivi app.

You then get an anonymous voting card in your Yivi app. With that, you can cast your vote.

Get your voting card using **yivi**

[Open Yivi app](#)

[Show QR code](#)

▶ [What is Yivi?](#)

[Wissel naar het Nederlands](#)

# Decidos design

**Non-steering ballot: no images or colours for the ballot options, randomly ordered.**

Electo University  Election Student Council

▶ Step 2 of 4

## Fill in your ballot

Who should represent you in the Student Council?

- Sam Janssen
- Van Nguyen
- Pim Vos
- None of the above (empty ballot)

[Continue to casting vote](#)

[Wissel naar het Nederlands](#)

# Decidos design

**Re-cast option to prevent coercion, voters can overwrite their previous vote.**

Electo University  Election Student Council

▶ Step 2 of 4

## Fill in your ballot

Who should represent you in the Student Council?

Sam Janssen


Van Nguyen

Pim Vos

None of the above (empty ballot)

[Continue to casting vote](#)

[Wissel naar het Nederlands](#)

Electo University  Election Student Council

▶ Step 2 of 4

## Fill in your ballot

Who should represent you in the Student Council?

Sam Janssen

Van Nguyen

Pim Vos

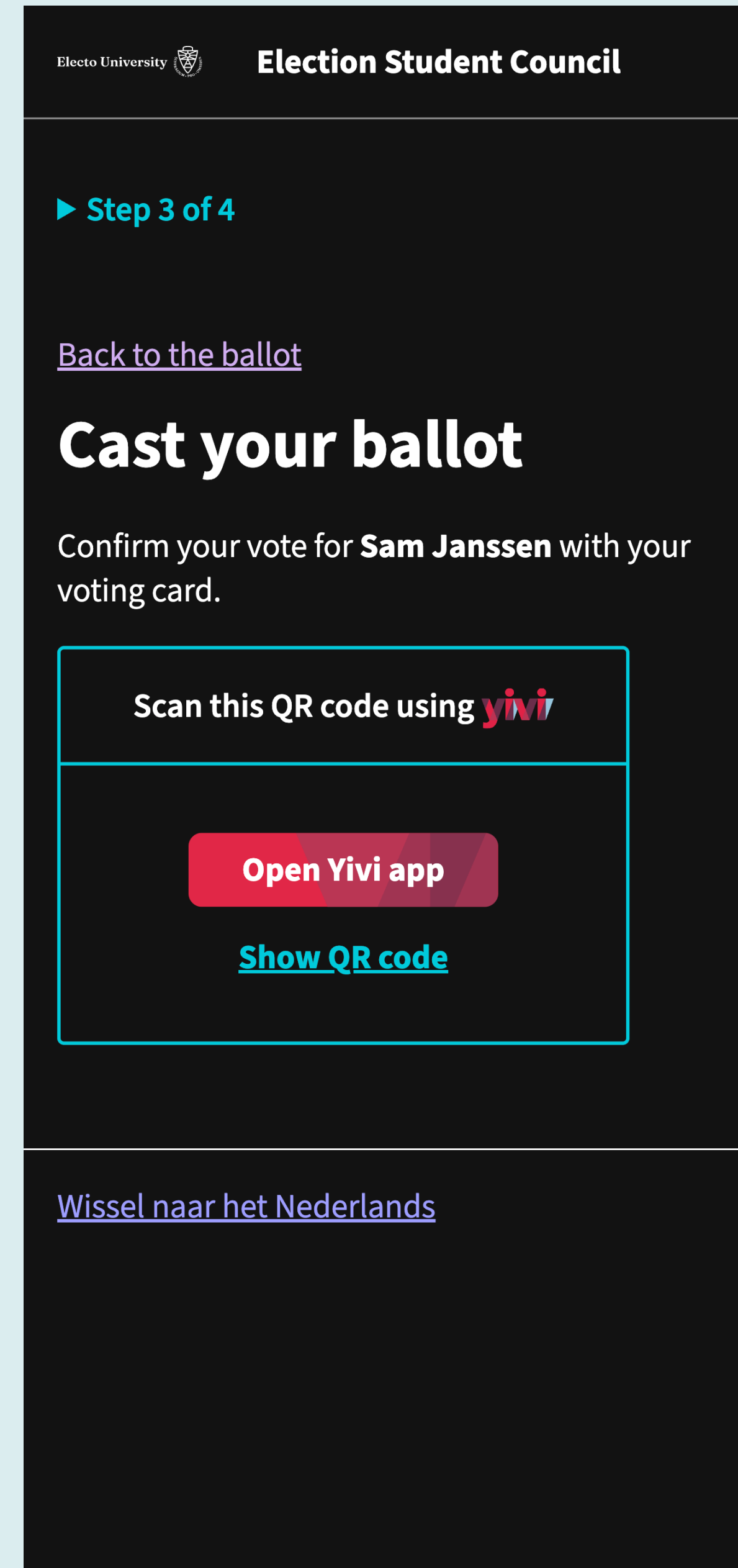
None of the above (empty ballot)

[Continue to casting vote](#)

[Wissel naar het Nederlands](#)


# Decidos design

**Plain language in short texts with large type.**  
**Color contrast conforms to WCAG AAA.**



# Decidos design

**Simple vote verification:  
Anonymous vote number  
disclosed with identity wallet.**

Electo University  Election Student Council

► Step 4 of 4

## See whether your vote was counted

You can ensure that your vote was counted by checking if your anonymous voting number is on the list.

► Why should I do this?

Scan this QR code using **yivi**


[Open Yivi app](#)

[Show QR code](#)

[Wissel naar het Nederlands](#)

# Decidos design

**Responsive to the screen size, colour (dark or high contrast mode) and reduced motion preferences.**

Electo University  Election Student Council

► Step 4 of 4

## See whether your vote was counted

You can ensure that your vote was counted by checking if your anonymous voting number is on the list.


► Why should I do this?

Scan this QR code using **yivi**

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[Wissel naar het Nederlands](#)

Electo University  Election Student Council

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[Open Yivi app](#)

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[Wissel naar het Nederlands](#)

# Advantages

## Wallet-based voting

- Various ways to handle voting eligibility (various attributes)
- Good balance between usability, accessibility and security
- Simple vote verification

# Caveats

## Wallet-based voting

- Not intended for large-scale, high-stakes elections (e.g., national elections)
- Only Yivi supports blind issuance of attributes/anonymous voting cards
  - This is not part of ARF of EU identity wallet
  - Depends on zero-knowledge crypto
- Further research needed to confirm/improve usability and accessibility

# Research

## Wallet-based voting

### Decidos: Accessible, Usable and Secure Voting in Low-stakes Elections Using Identity Wallets

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#### Abstract

Online election platforms face security, usability, and trust problems. We propose an election platform based on identity wallets, which could help overcome these issues. In our setup, voters first prove they are eligible to vote by disclosing relevant aspects of their identity (such as their student or employee number) to the platform, with their identity wallet. They then receive an anonymous voting card in their wallet, which they can use to both cast their vote and verify that the vote has been counted. Our platform is intended for low-stakes elections, such as local consultations or student council elections. Its design integrates design recommendations from existing literature. This paper provides a background on (online) elections and relevant design principles, and then presents our working prototype as well as future plans to facilitate secure, low-stakes online elections that are accessible to all.

#### CCS Concepts

• **Security and privacy** → **Usability in security and privacy**; • **Human-centered computing** → *Web-based interaction*; *Usability testing*; **User centered design**; *Accessibility design and evaluation methods*.

#### Keywords

identity wallet, e-voting, i-voting, accessibility, interaction design, security, privacy

#### ACM Reference Format:

Floris M. Jansen, Hanna Schraffenberger, and Bart Jacobs. 2026. Decidos: Accessible, Usable and Secure Voting in Low-stakes Elections Using Identity Wallets. In *Extended Abstracts of the 2026 CHI Conference on Human Factors in Computing Systems (CHI EA '26)*, April 13–17, 2026, Barcelona, Spain. ACM, New York, NY, USA, 8 pages. <https://doi.org/10.1145/3772363.3798937>

#### 1 Introduction

Traditionally, voting in elections has happened on paper. Over the past decades, however, some parts of the voting process have been digitised in the shape of voting machines [43] and tallying software [4]. More recently, solutions for voting over the internet (i-voting) have been developed. There are now many platforms for low-stakes elections [11, 23, 24, 40], and some used as an addition to postal voting [57] or general voting [28] in national elections.

Elections come with requirements to make sure the outcome is trustworthy. For instance, the process should be transparent (so voters can believe their vote is counted), votes should be anonymous (so people cannot be coerced, meaning they do not sell their votes or vote under duress), and each vote should be cast by a single, eligible person [18].

Online election platforms have come up with different ways to fulfil those requirements. However, a secure election platform with great accessibility, usability, and a pleasant user experience is still missing [16] (see also subsection 2.1). This is particularly problematic because online election platforms are already in use. Here, security or usability problems sometimes lead to do-overs or debated results, such as in a party leader election of a Dutch political party in 2020 [5, 56]. This election had to be repeated because attackers could vote multiple times by brute-force guessing voting codes sent over email, among other issues. This shows the societal need for more secure and usable online election platforms.

In this paper, we build on the idea of using identity wallets to address this need for a secure, usable and accessible election platform. Identity wallets are an emerging concept that allows providing proof of personal attributes (such as one's name) or anonymous attributes (such as one's nationality). These wallets will become widely available in the European Union at the end of 2026, as required by the eIDAS 2.0 regulation [7]. While identity wallets can be used for many purposes, such as authentication for online services [13], signing documents [41], or email encryption [19], they are also a viable solution for a public election platform. Here, an identity wallet can be used to prove voting eligibility and receive an anonymous voting card. This card can be used for ballot casting and vote verification. A technical system design for this approach has already been described, previously [27, 62]. With this work, we want to investigate whether this system can be realized in an accessible and usable way.

To do that, we are designing and developing *Decidos*: an election platform that uses identity wallets for online decision-making. It is meant for low-stakes elections, such as those for (small) shareholder meetings, homeowners' associations, internal democracy in political parties, student councils, or municipal initiatives. The design and development are carried out in collaboration with several stakeholders in the public and private sectors.

This paper describes the first steps we have taken in designing the interface for this system. The main contributions are twofold. First, we synthesize and summarize the relevant existing usability work that can inform the design of online election platforms (section 2). This includes an overview of election requirements, open problems in existing systems, and usability recommendations. Second, we propose a new interface for an online election platform

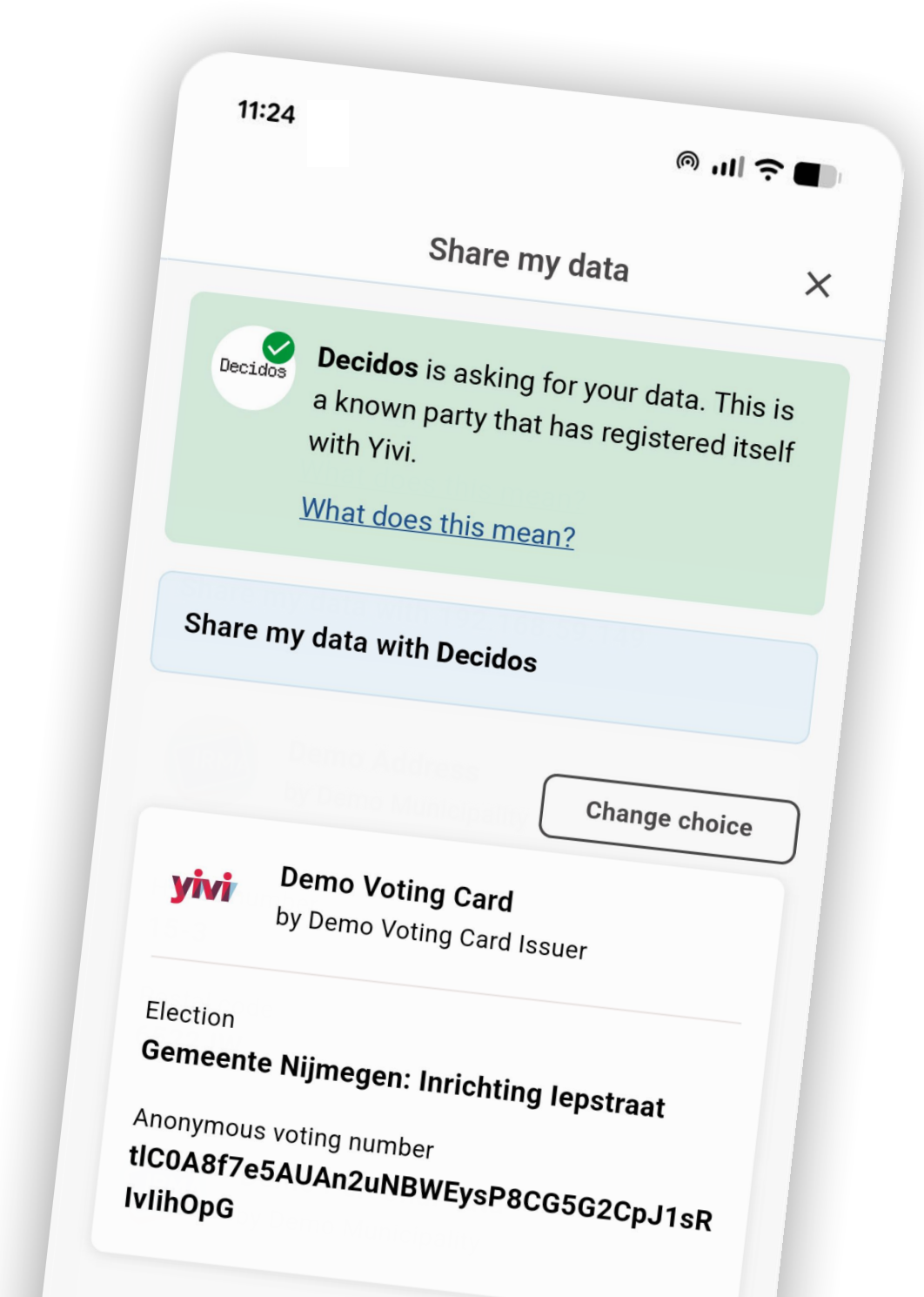


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ACM ISBN 979-8-4007-2281-3/2026/04  
<https://doi.org/10.1145/3772363.3798937>

# Research plans

## Wallet-based voting

- Usability testing: measuring trust, efficiency, effectiveness and satisfaction
  - How does the use of identity wallets impact voting experience?
  - Do users understand the role of identity wallets?
  - Should we show the split server design and if so, how?



# Research plans

## Wallet-based voting



### Election Design

What do you want to happen v

### Voting takes four st

1. [Get your voting card](#)

Prove that you may vote

2. [Fill in your ballot](#)

Make a choice and fill it

## Decidos

### Election Design Iepstraat

#### Fill in your ballot

What do you want to happen with the existing parking spots on the Iepstraat?

- Keep the parking places
- Create a playground
- Replace two parking spots with waste containers
- None of the above (empty ballot)

### Iepstraat

otes.

Share of votes

Amount of votes

51%

602

31%

371

# Development plans

## Wallet-based voting

- Integrate design insights from user testing
- Technical refinements
- Platform to setup elections (organizer-side of things)
- Close collaboration with legal experts
- Working toward a *service* for small-scale elections
  - Possibly by Caesar and ProcoliX, like for [PostGuard.eu](https://PostGuard.eu)



# Voting with wallets

Using Yivi for online decision making