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L.A. COUNTY + IDEO

Deliverable 5.1.2
In-process BMD Hardware
"Works-Like" Prototypes

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VOTING PRINCIPLES

Goals for Hardware Prototypes 5.1.2

4 *The voting system must instill **public trust** by having the ability to produce a physical and tangible record of a voter's ballot to verify the ballot was marked as intended before it is cast and to ensure audibility of the system.*

- Voters should be able to review the marked ballot and verify their selections privately and independently.
- The role of the paper ballot should be understood by the voter.

7 *The voting system must guarantee a **private and independent** voting experience for all voters, including voters with a full range of types of disabilities and voters with limited English proficiency.*

- The BMD display should strike the right balance of large enough text for legibility, while still maintaining a sense of privacy.
- Voters should be able to cast their ballots privately and independently.

8 *The voting system must be **easy** for all voters to use, in particular, for voters with a full range of types of disabilities and voters with limited English proficiency.*

- The BMD should be able to adjust to provide a good voting experience, regardless of whether a voter is short or tall, able bodied or in a wheelchair.
- The paper path for inserting, verifying and casting the ballot should be intuitive to use and easily accessible to voters.

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GOALS

Hardware Prototypes 5.1.2 User Studies

1. How do **central and integrated ballot boxes** compare in terms of usability (efficiency, ease of use, ease of learning, user satisfaction), perceived privacy and accessibility?
2. How do we provide a highly usable experience for **speakers of other languages**?
3. What are usable, accessible, and private ways to **manage the paper ballot**?
4. How do voters want to **customize their experience** in terms of making the screen angle and user interface comfortable for them?

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Prototype	5.1.1	5.1.2
Display Size	12.3”,15.6”, or 18.4”	15.6”
Display Orientation	Portrait or Landscape	Portrait
Paper Path	Multiple location options. Non-functional	Right of display, paper inserted up or horizontal. Feeds paper in and out.
Height	21-37” knee clearance	30” knee clearance
Display Adjustment	6 degrees of freedom: 3 pivot axes +3 translation directions	Single pivot
Screen Setting Adjustment	On-Screen	Test hard buttons vs. on-screen

CHANGES FROM PROTOTYPE 5.1.1

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Sidecar Architecture

Monolith Architecture

BMD PROTOTYPES 5.1.2

Overview of Prototypes

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Sidecar Architecture

Monolith Architecture

BMD PROTOTYPES 5.1.2

Overview of Prototypes: Additional Views (privacy shield removed for visibility)

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SIDECAR ARCHITECTURE

Overview of features

1. 15.6” touchscreen display.
2. Two friction hinges deliver 60 in-lb of torque to position display
3. Two hard buttons for changing display contrast and text size
4. Ballot access slot with simulated paper path
5. Privacy Screen
6. 30” of knee clearance

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Inserting ballot

Adjusting screen angle

Interactive with buttons

Wheelchair access

SIDECAR PROTOTYPE 5.1.2

Overview: Additional Views

SIDECAR PROTOTYPE 5.1.2

Screen Adjustment

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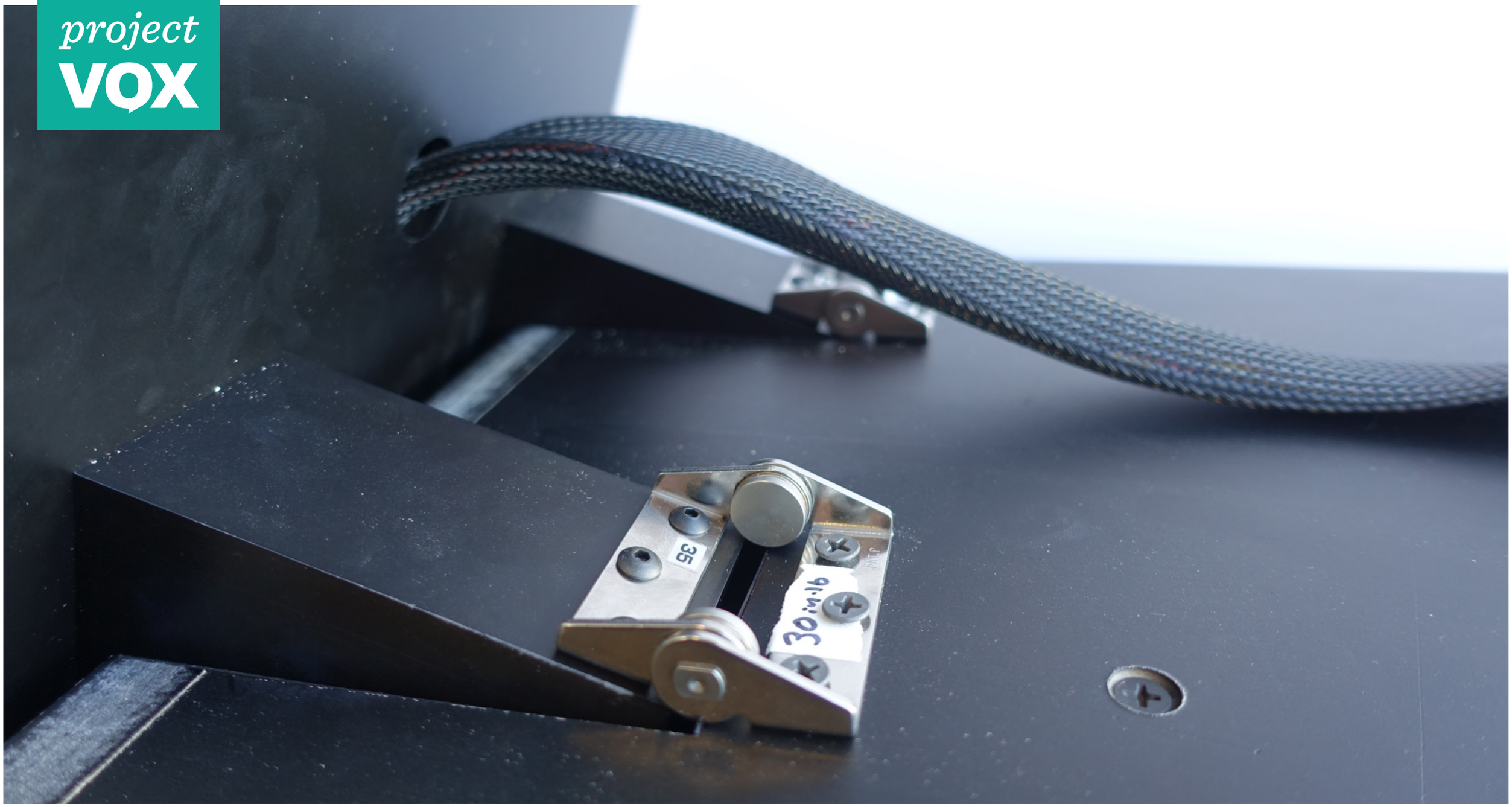

Two friction hinges, each supplying 30 in-lb of torque, hold the display in position.

SIDECAR PROTOTYPE 5.1.2

Hinge Mechanism

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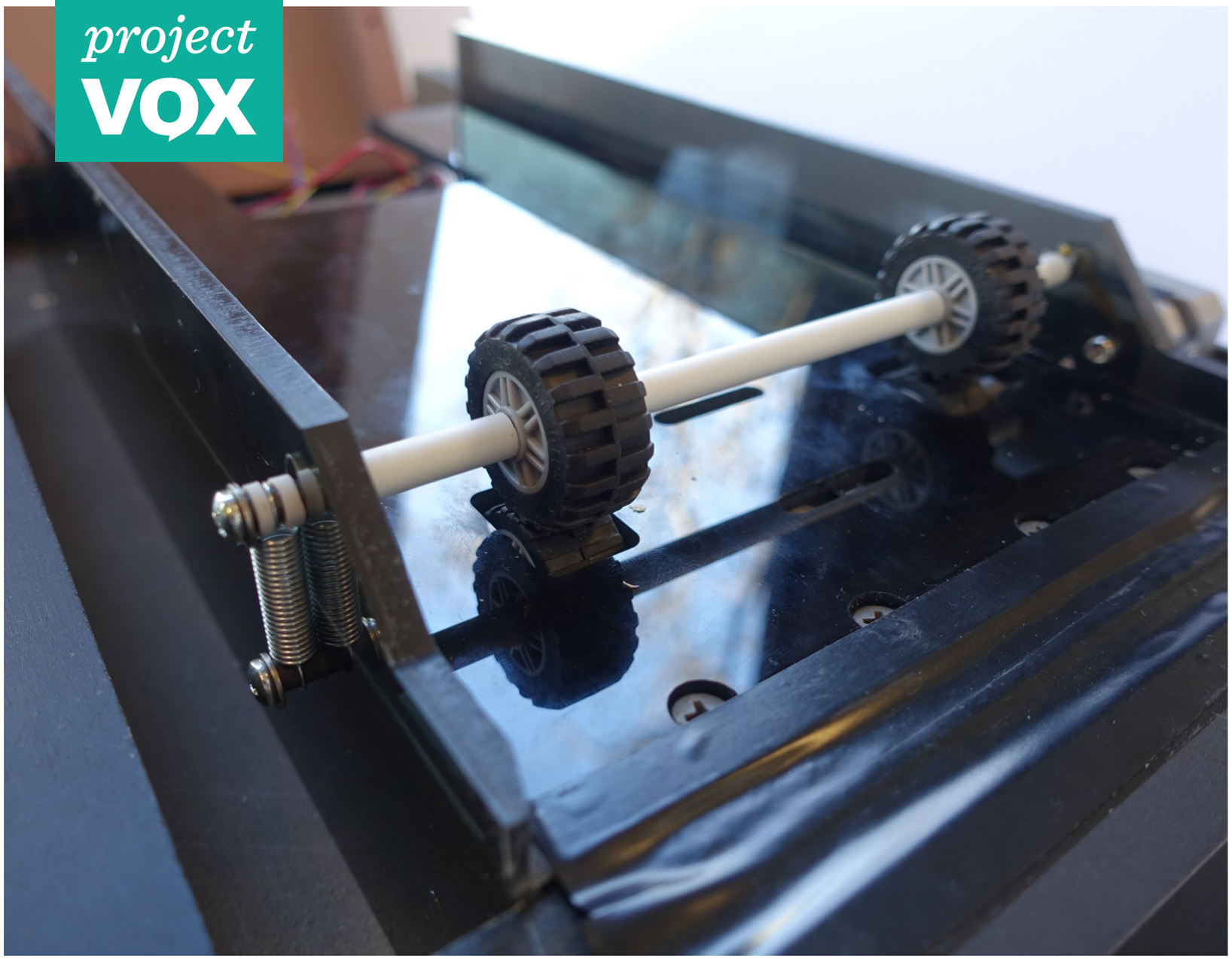
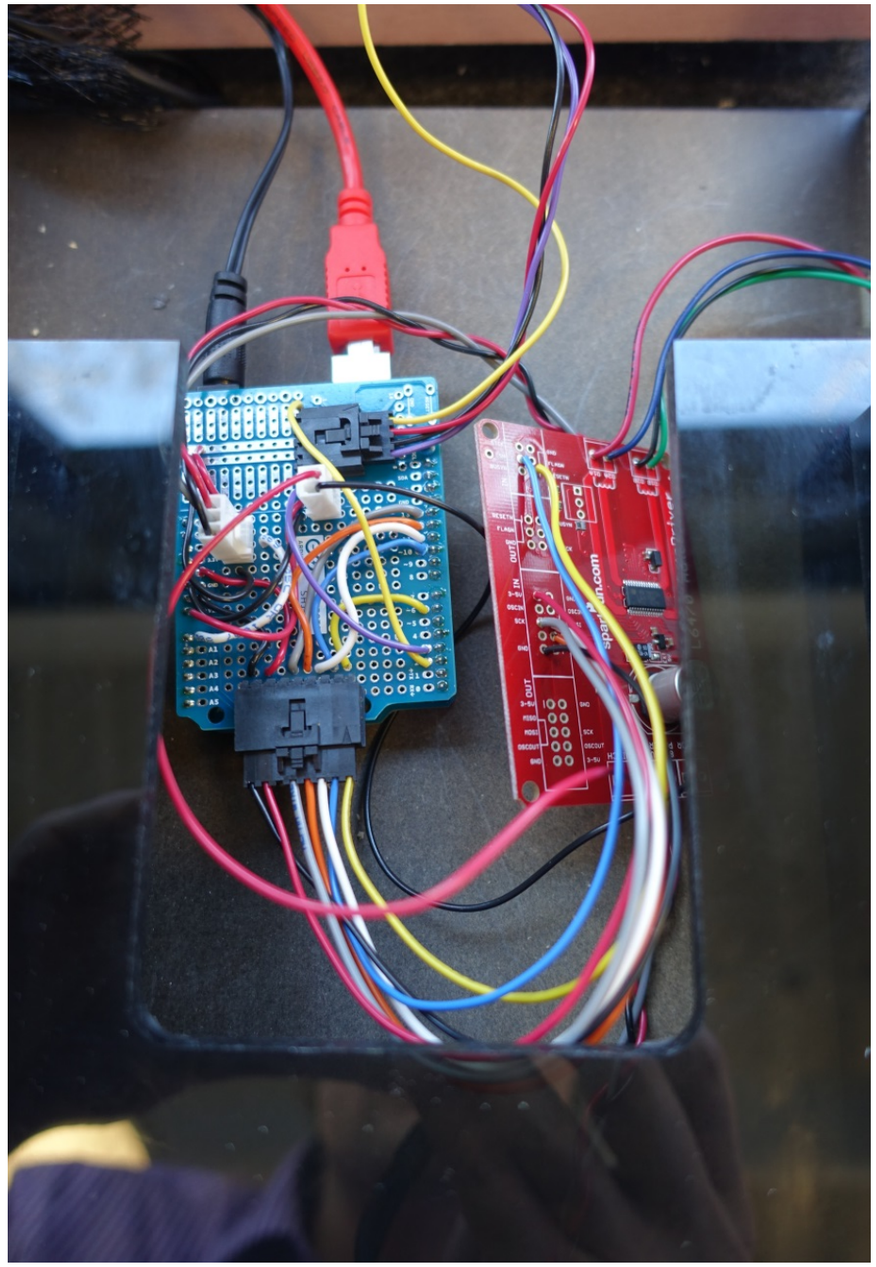
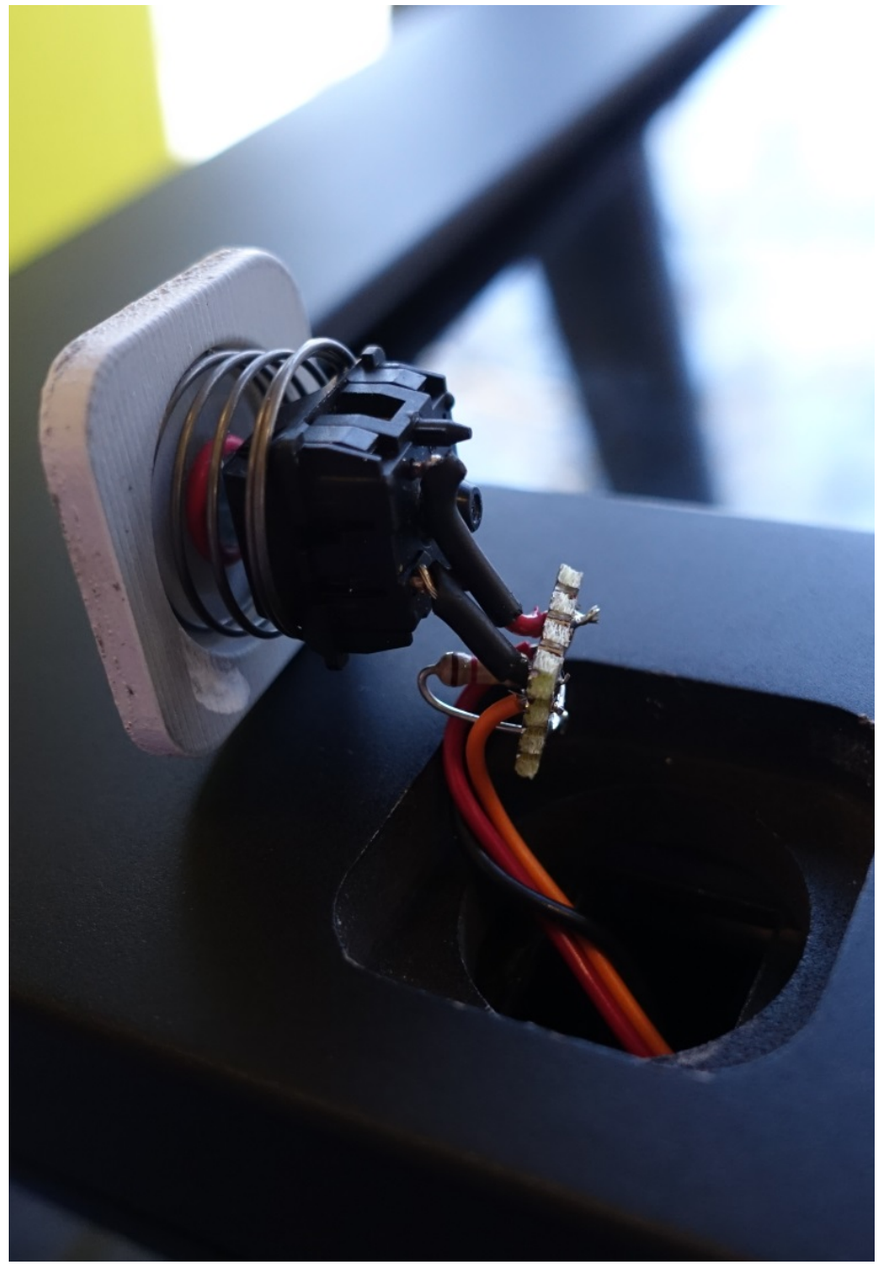




Paper path was simulated using Lego wheels, a stepper motor and an Arduino board with motor driver and communication protocol (keyboard strokes) with the integrated laptop that runs the UI. An optical switch detects the presence of the ballot and activates the motor to draw the paper in. The ballot is held inside the unit until the voter prompts "print" in the UI and triggers the motors to return the ballot to the voter.

SIDECAR PROTOTYPE 5.1.2

Paper Path



Physical buttons to control text size and contrast were created using mechanical keyboard switches and compression springs. Keystrokes are communicated to the integrated laptop that runs the UI via the Arduino board.

SIDECAR PROTOTYPE 5.1.2

Hard Buttons

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MONOLITH ARCHITECTURE

Overview of features

1. 15.6” touchscreen display.
2. Paddle latch actuates screen lock. Locking gas spring used to "lock" screen position and acts as a counterbalance. Light friction hinges are easily moved when the lock is released.
3. Ballot access slot with simulated paper path.
4. Acrylic ballot cover
5. Privacy Screen
6. 30” of knee clearance

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Inserting ballot

Adjusting Screen Angle

MONOLITH PROTOTYPE 5.1.2

Overview: Additional Views (privacy shield removed for visibility)

MONOLITH PROTOTYPE 5.1.2

Screen Adjustment

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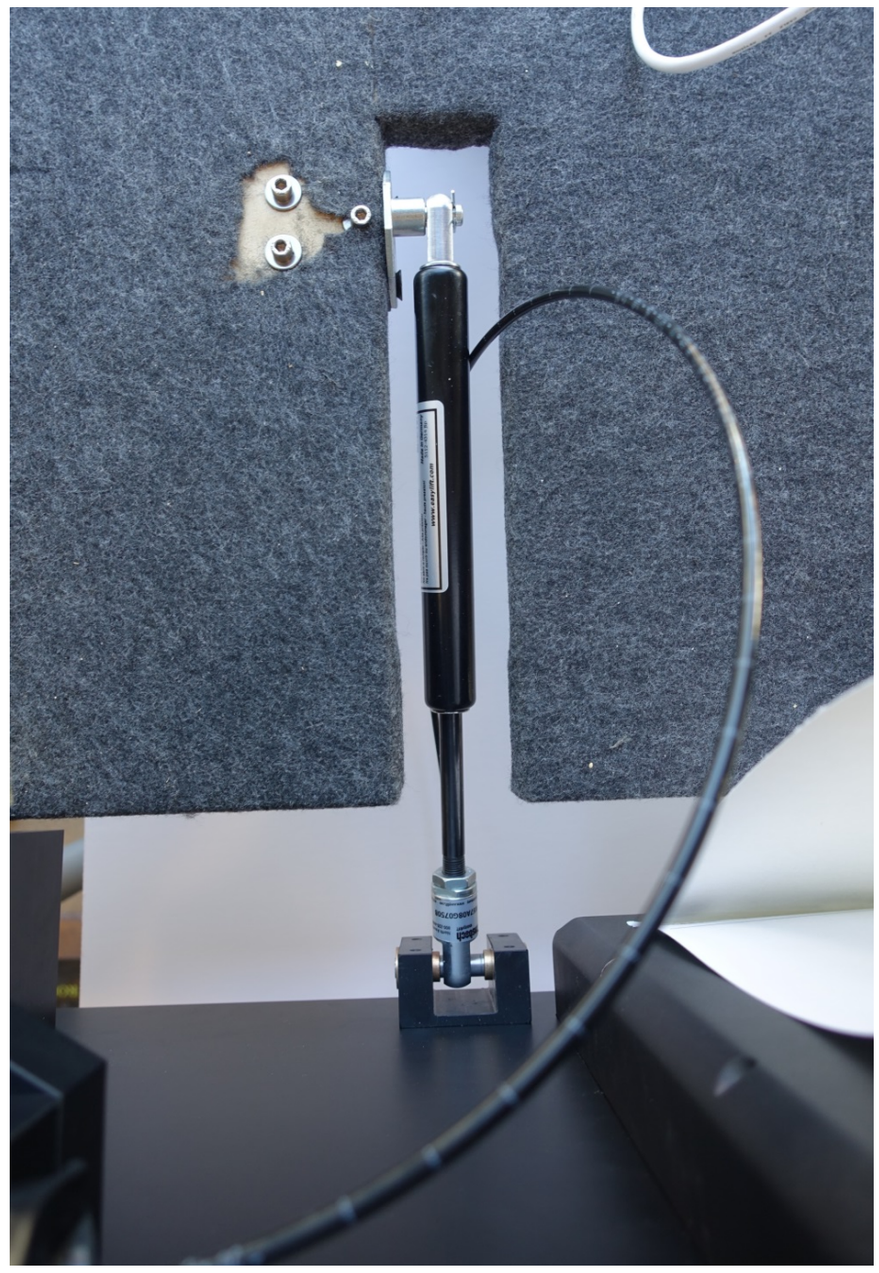

1 Release lever for gas strut

2 40 lbs. locking gas strut

3 Friction Hinges

MONOLITH PROTOTYPE 5.1.2

Hinge Mechanism

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1 Latch release for gas cylinder lock

MONOLITH PROTOTYPE 5.1.2

Handle Details

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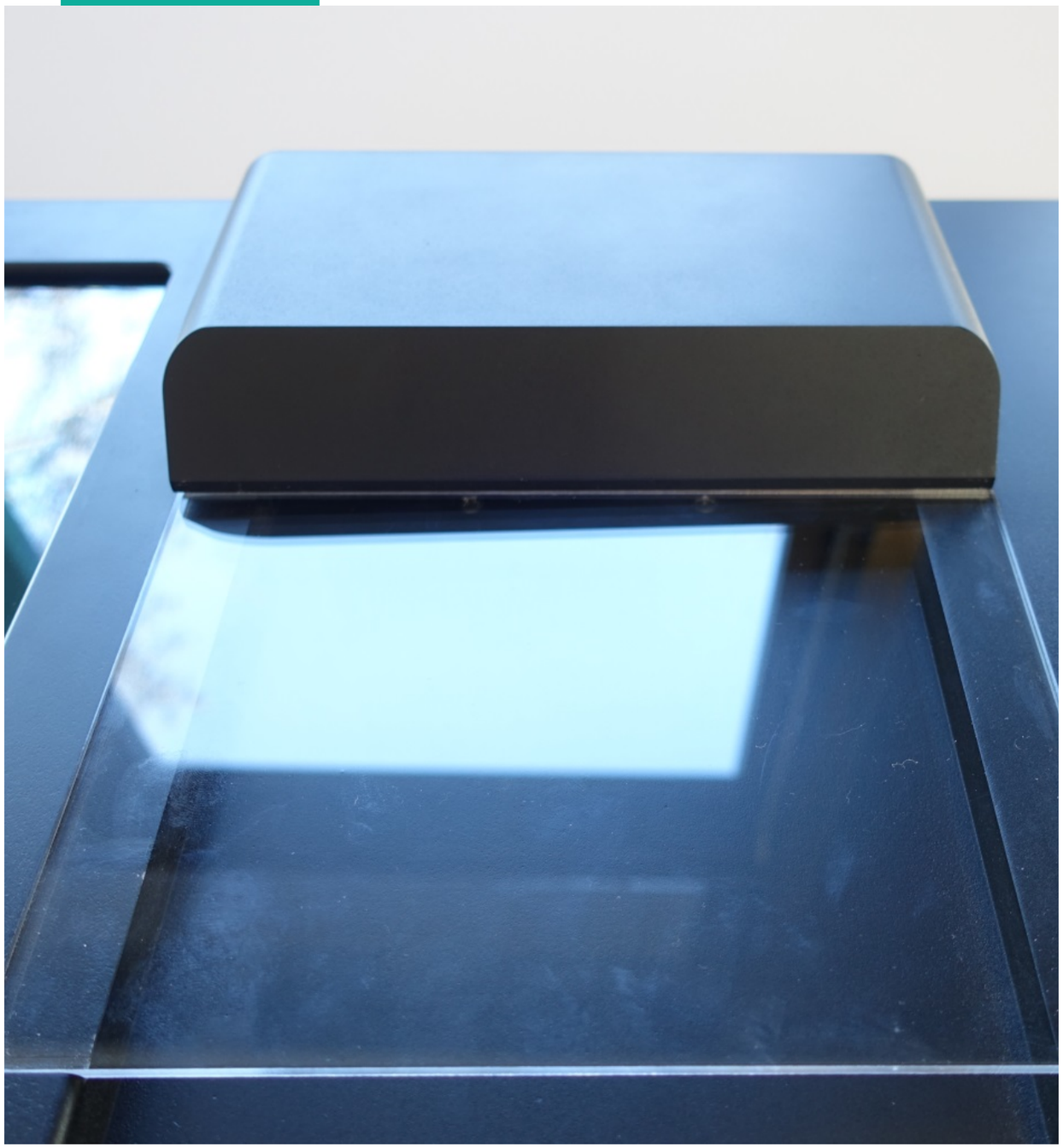
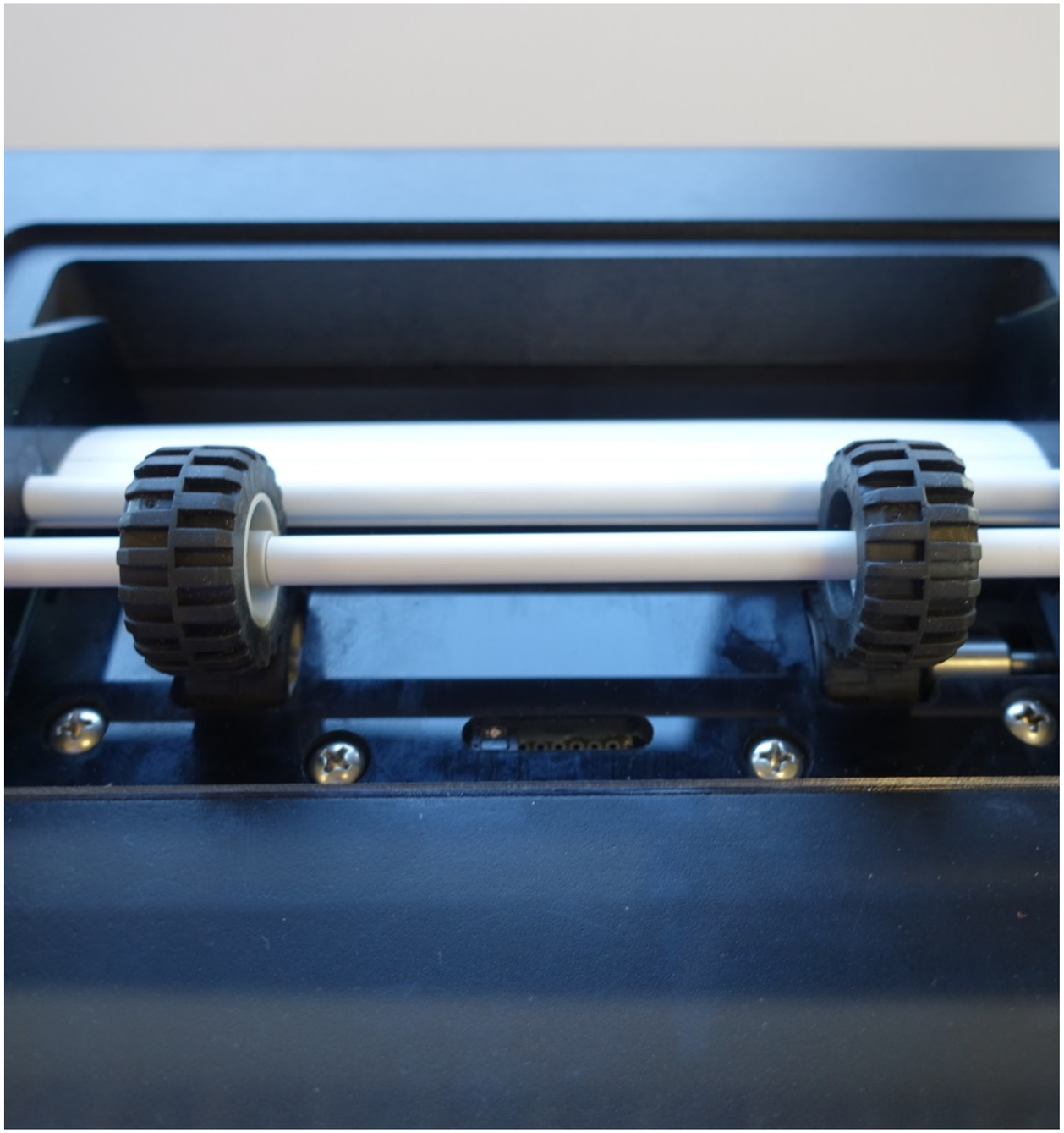


Paper path with cover on



Detail of paper feed mechanism

MONOLITH PROTOTYPE 5.1.2

Paper Path

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NEXT STEPS

Testing, Feedback, Conclusions

This randomized control trial of the voting experience provided the IDEO team with qualitative and quantitative data to inform our iterative design process.

Data analysis led to the following insights:

- *Although both central and integrated ballot boxes are acceptable options,and both require more design work to make them truly intuitive, the integrated ballot box is more usable, private, and accessible.*
- *Voters who speak other languages preferred to see both the original English and the translation into their preferred language together. A monolingual experience is reasonably usable and accessible but would be substantially enhanced by the ability to easily toggle between preferred language and English.*
- *Ballot slot should be familiar (like the sidecar prototype) and enable voters to manage and review the ballot with ease (like the monolith prototype).*
- *Voters found the prototype's default settings fairly usable, in terms of screen angle, text size, and contrast. Letting them know that they can customize these things for their comfort and privacy will require better discoverability and clearer guidance.*