A Hybrid Touch Interface for Prêt à Voter

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Trustworthy Voting Systems Project



Overview

- Brief Introduction to Prêt à Voter
- Motivation
- Hybrid Touch Concept
- Implementation Prototypes
- Future Work

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Voting in Prêt à Voter

- Fill in ballot form
- Detach and destroy Left Hand Side
- Submit Right Hand Side to the system (scan)
- Receive signed receipt from Web Bulletin Board (WBB)
- Right Hand Side is published on WBB

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Test Election 1

Cathy	
Eliot	
Geena	
Daniel	
Ben	
Ivy	
Hannah	
Frederick	
Ali	



Test Election 1

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Properties

- Privacy
  - The Right Hand Side does not reveal how you voted
  - No machine learns how you voted
- End-to-end verifiability
  - Voters can check the inclusion of their vote
  - 3rd parties can check each operation
- Strong integrity guarantees
- Accessibility?

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Accessibility of Voting in the UK

- Limited
  - Tactile Voting Device (2001)
- Polls Apart Campaign
  - Reports after each election
  - Works with Electoral Commission



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Motivation

- Accessibility is a requirement of any new voting scheme in the UK
- Round table discussion with Polls Apart 2010
- Polls Apart Report 2010 recommendation:
  - "Ensure disabled people can vote independently and in secret by diversifying voting methods..."

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Motivation

- We often have to make a pragmatic choice about accessibility and privacy
  - If we want the system to help the voter cast their vote, it generally has to learn how they vote
- Can we develop a front-end, for Prêt à Voter, which does not compromise on privacy?

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Previous Ideas

- Previously suggestions have been to line up a left hand side paper ballot with a touch screen
  - Not really usable, let alone accessible

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Hybrid Touch Concept

- Maintains the concept of two halves of a ballot paper
- Left hand side is paper based
- Right hand side is digital
  - rendered on a touch screen or Surface Computer
- How it works:
  - Detect location and orientation of left hand side
  - Render right hand side in appropriate location
  - User interacts by touching virtual right hand side

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What are the advantages?

- Machine does not learn how voter has voted
- Additional accessibility equipment can be added to assist in the vote casting (Large buttons, sip and puff, voice control, etc.)
- Automatic validation of correct entry
- No scanners
  - No need to interpret human handwriting/OCR
- The process of voting is entirely completed within the booth

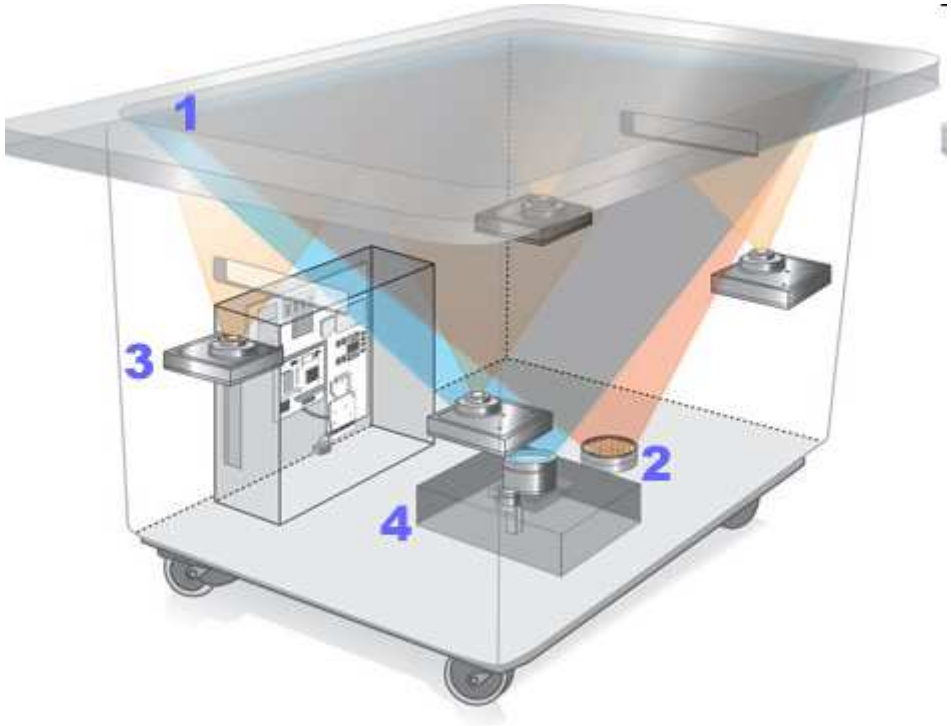
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Implementation - Microsoft Surface

- Natural User Interface
- Interacting with everyday objects
- Microsoft Surface consists of:
  - direct interaction
  - multi-touch contact (50 touches)
  - a multi-user experience
  - object recognition via Identity Tags

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How Does Microsoft Surface Work?



http://www.popularmechanics.com/technology/industry/4217348.html?page=2

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Trustworthy Voting Systems - Demo Application

Races
President - Empty
Referendum - Empty
Local Council - Empty



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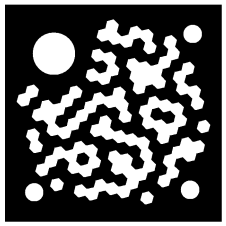
Prêt à Voter

Place your ballot paper on the surface

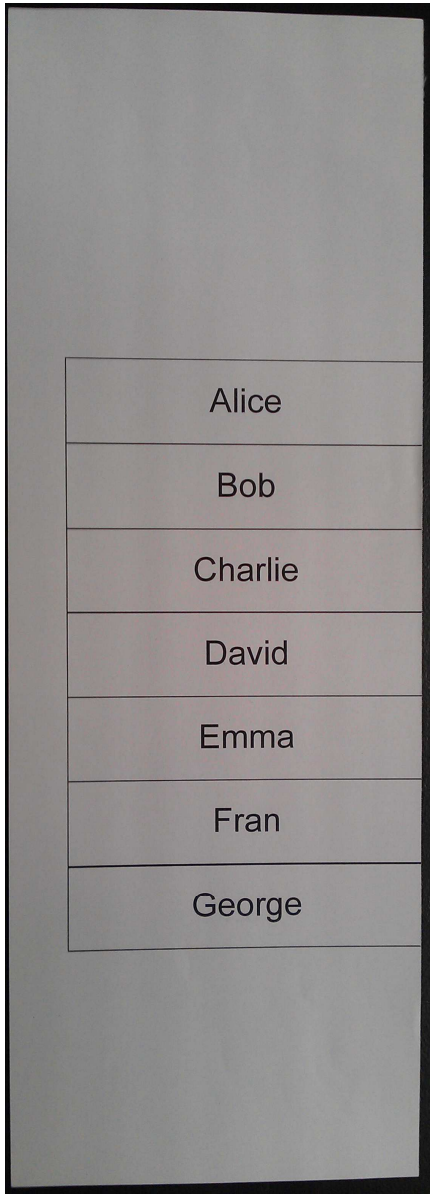
Cast Vote

Microsoft Surface – Ballot Paper

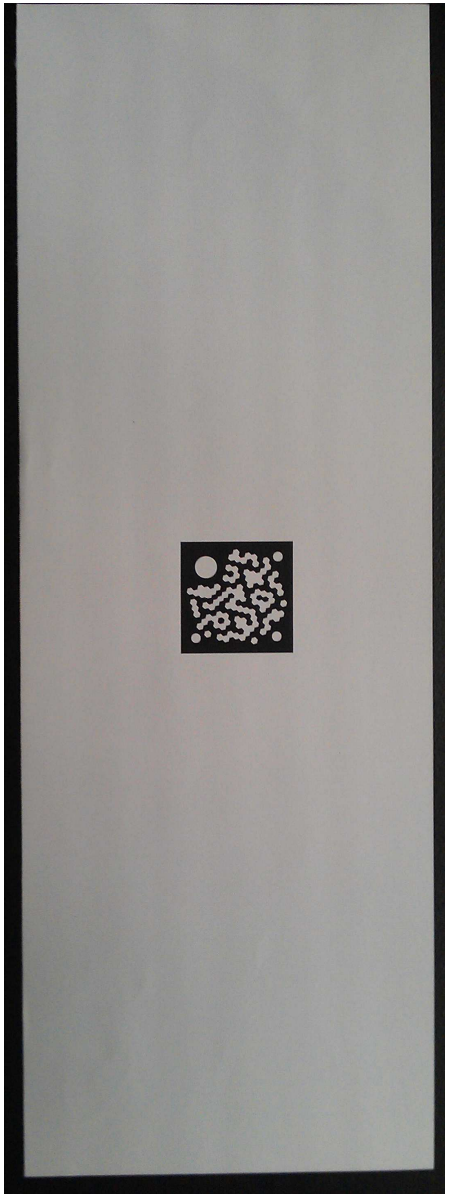
- Easy to construct
- Standard Prêt à Voter ballot paper
  - Additional Identity Tag on underside
  - Contains same information as Right Hand Side barcode
  - Identity Tag used for orientation and location



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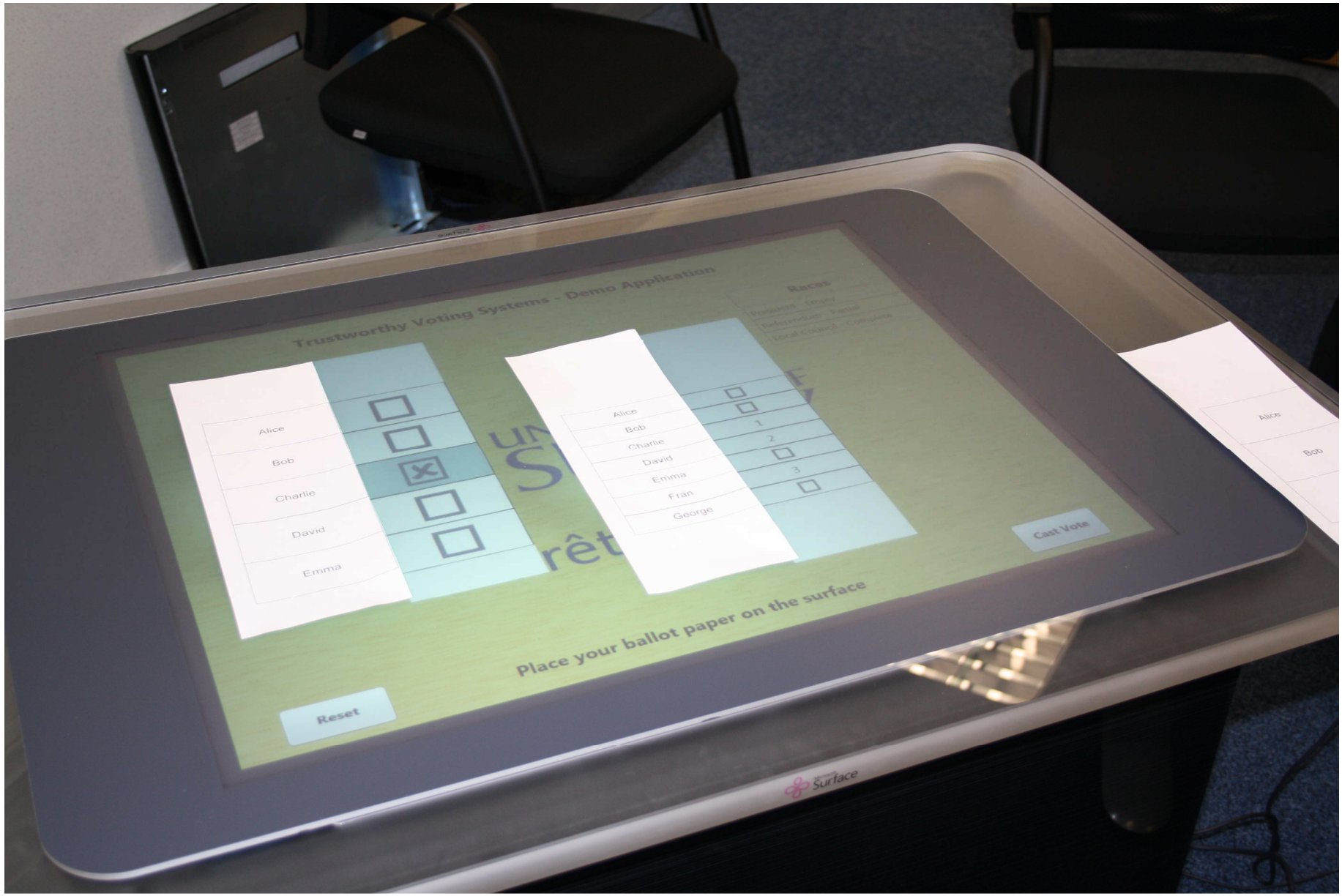
Front



Back

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Microsoft Surface



Implementation - Microsoft Surface

- Expensive – approximately £10,000
- Large and immobile
  - Practical issues of locating them
  - No easy way to adjust height

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3M Multi-Touch - Projected Capacitance

- 3M Multi-Touch can handle 20 touches (M2256PW)
- Similar technology as on modern mobile phones
- Two layers of perpendicular wires
- A charge is applied creating capacitance at the intersections
- Bringing a finger or conductive stylus within the electrostatic field causes a change in the capacitance
- This change is used to identify the location of the touch

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Projected Capacitance Technology

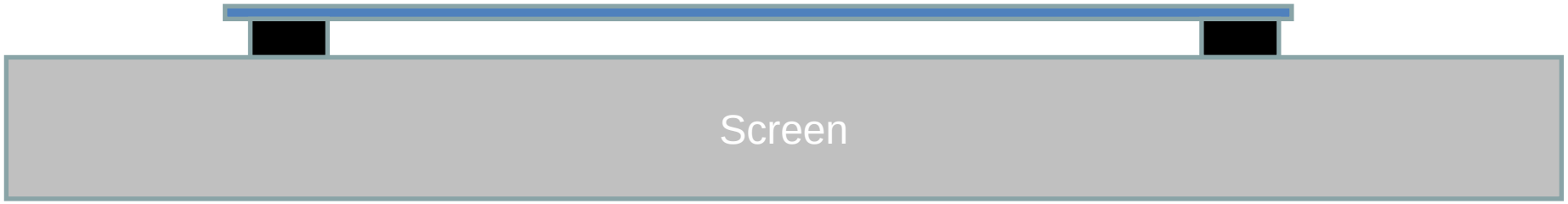
- How we could use it:
  - Use conductive ink/foil marks on the underside to simulate touches
  - Define a template of simultaneous touches that indicate a ballot (currently a rectangle of a specific size)
  - Use these touches to determine location and orientation

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Projected Capacitance

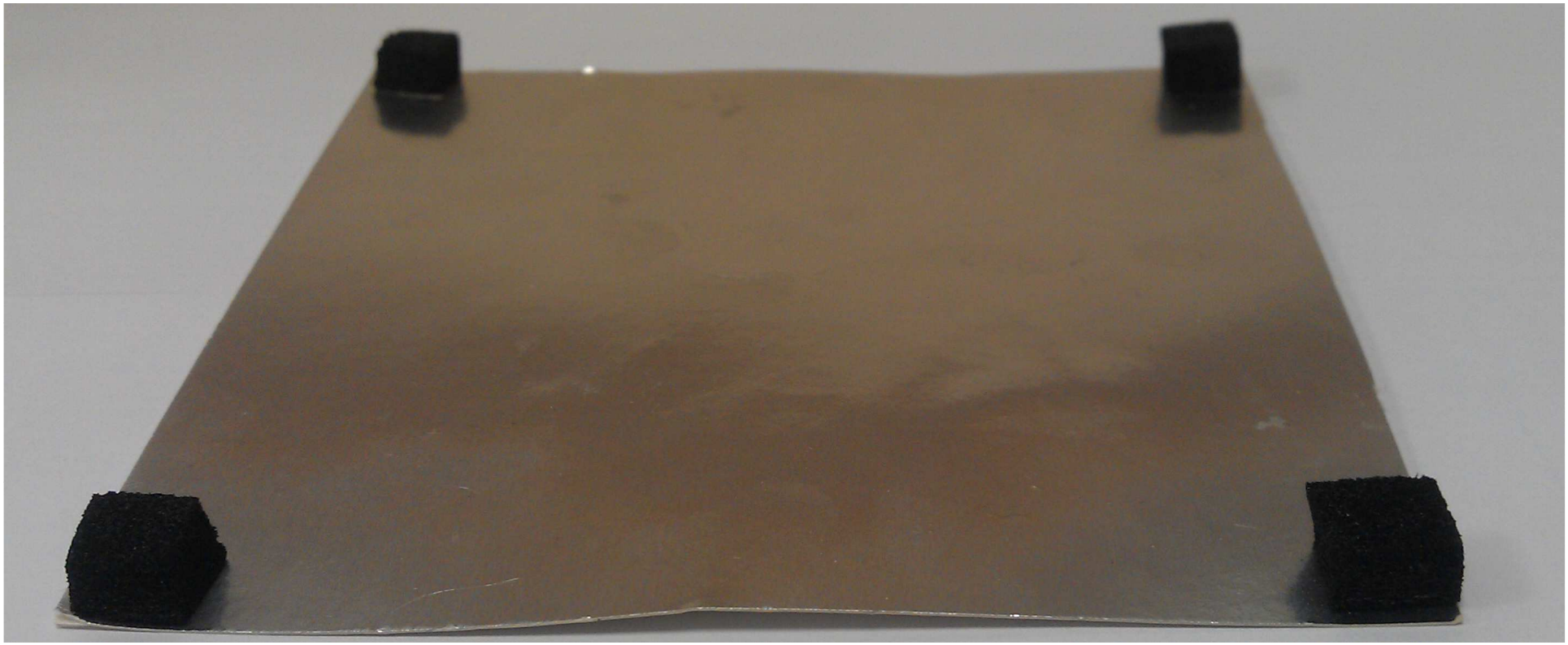
3M Multi-touch screen

- Foil backed card
- Conductive foam pads (6mm)
- Able to locate and orientate a left hand side
- Display virtual right hand side



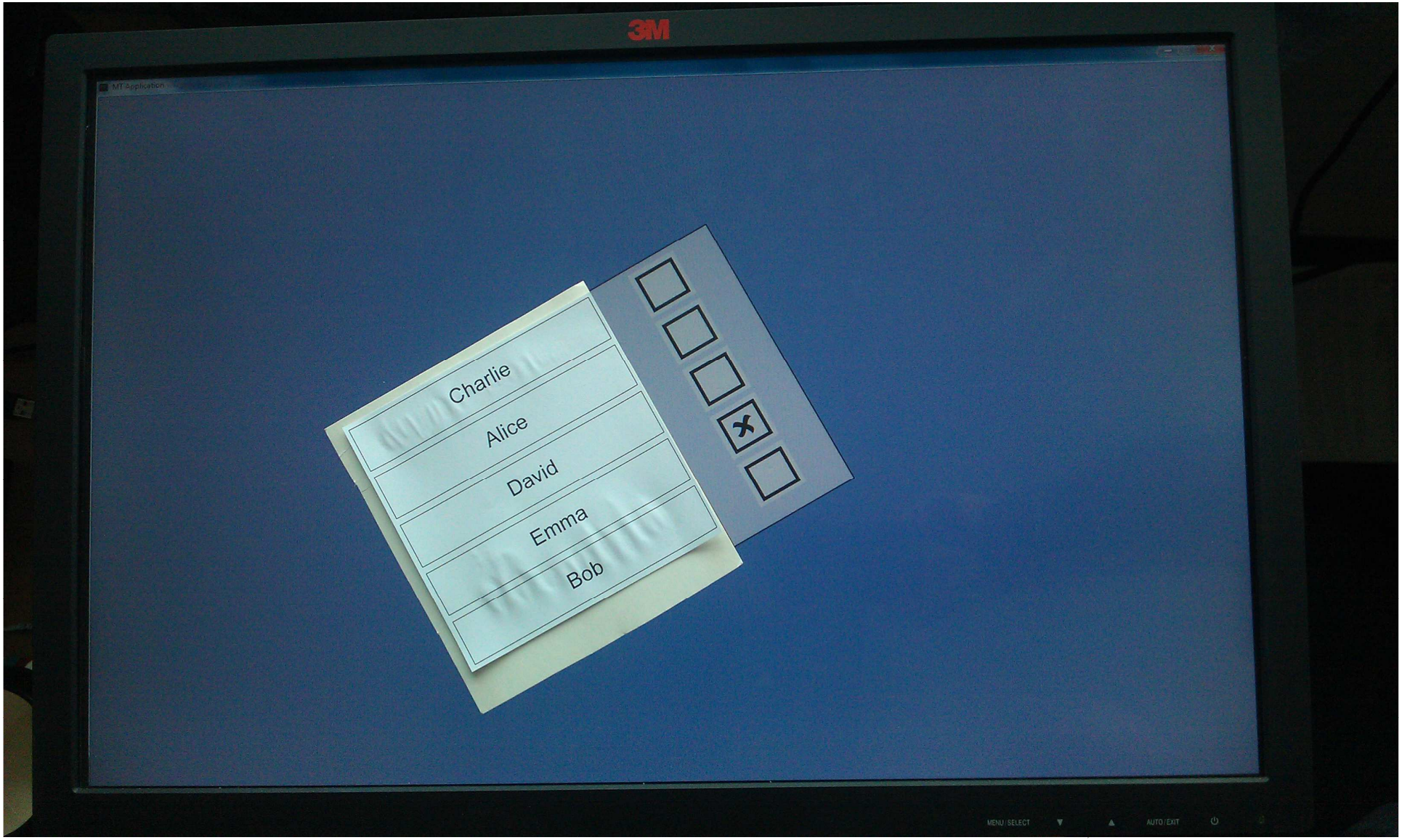
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Projected Capacitance Ballot



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Projected Capacitance



Projected Capacitance

- Cheaper and more flexible
- Currently still need to scan a barcode to acquire serial number
  - Looking into using multiple conductive pads in a sparse matrix on the underside to provide that information
- Ballot paper is more difficult to construct

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Microsoft Surface – Version 2

- Samsung SUR40 with Microsoft PixelSense
- Only 103mm thick
  - Can be mounted on an arm for adjustment



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Summary

- Developed an interface that provides some accessibility without compromising privacy
- Proof of concept
  - Microsoft Surface
  - Multi-touch screen

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Future Work

- Further work needed to polish user interface
- Reduce size of conductive pads
- User Trials

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QUESTIONS?

