

# Usability of Mobile Voting Using NFC Technology

Kerem Ok, Vedat Coskun, Mehmet N. Aydin

[www.NFCLab.com](http://www.NFCLab.com)

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# Usability of Mobile Voting with NFC Technology

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- Requirements for a **secure remote electronic voting system** are analyzed and identified
  - A **remote electronic system** is developed using NFC technology
    - named as **NFC voting**
  - System's **subjective usability** is evaluated and compared with **web-based voting's** usability
  - Findings
    - NFC voting **satisfies** electronic voting requirements
    - NFC technology **increases the subjective usability** of remote electronic voting process
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# Outline

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- Remote Electronic Voting
- NFC (Near Field Communication)
- NFC Voting Model
- Scenarios
- Experiment and Results
- Conclusion

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# Electronic Voting System

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- Voting using electronic devices such as notebooks, mobile phones, or PDAs
- Vote is transmitted over Internet
- Voter is identified via remote verification mechanisms
  - Digital signature
  - Biometrics
  - PIN codes

# Electronic Voting System Requirements

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## 1. Accuracy

- ❑ A vote should not be altered
- ❑ An invalid vote should not be counted in the final tally
- ❑ It should not be possible to eliminate a validated vote from the final tally

## 2. Democracy

- ❑ Only eligible voters should be able to vote
  - ❑ All eligible voters may vote only once
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# Electronic Voting System Requirements

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## 3. Anonymity

- ❑ A ballot should not be linked back to the voter who casted it

## 4. Verifiability

- ❑ Each voter may verify that her vote is counted

## 5. Mobility

- ❑ A voter may vote anywhere without any geographical restrictions.

## 6. Usability

- ❑ A system may be used by intended users to achieve specific goals.
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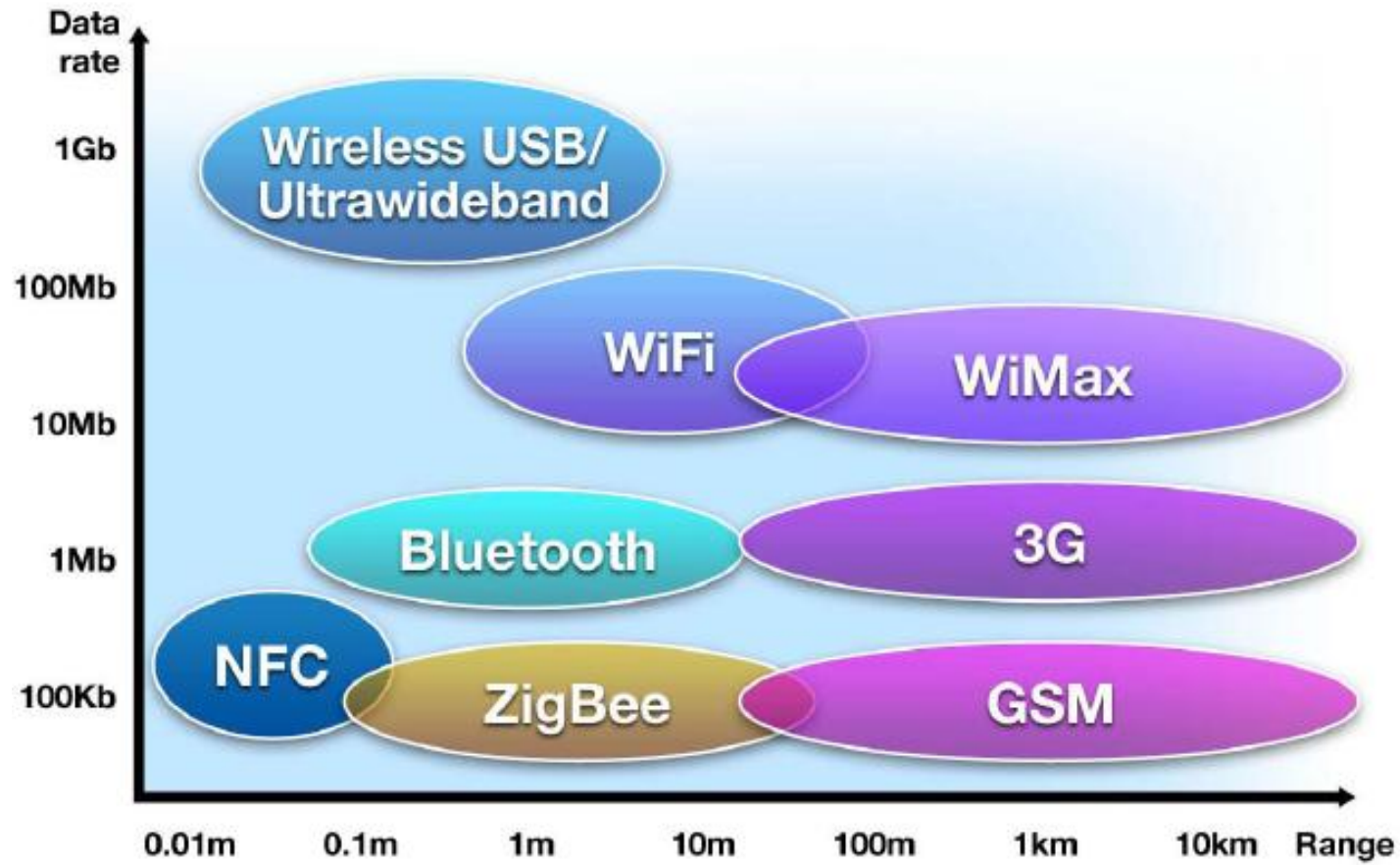


# NFC (Near Field Communication)

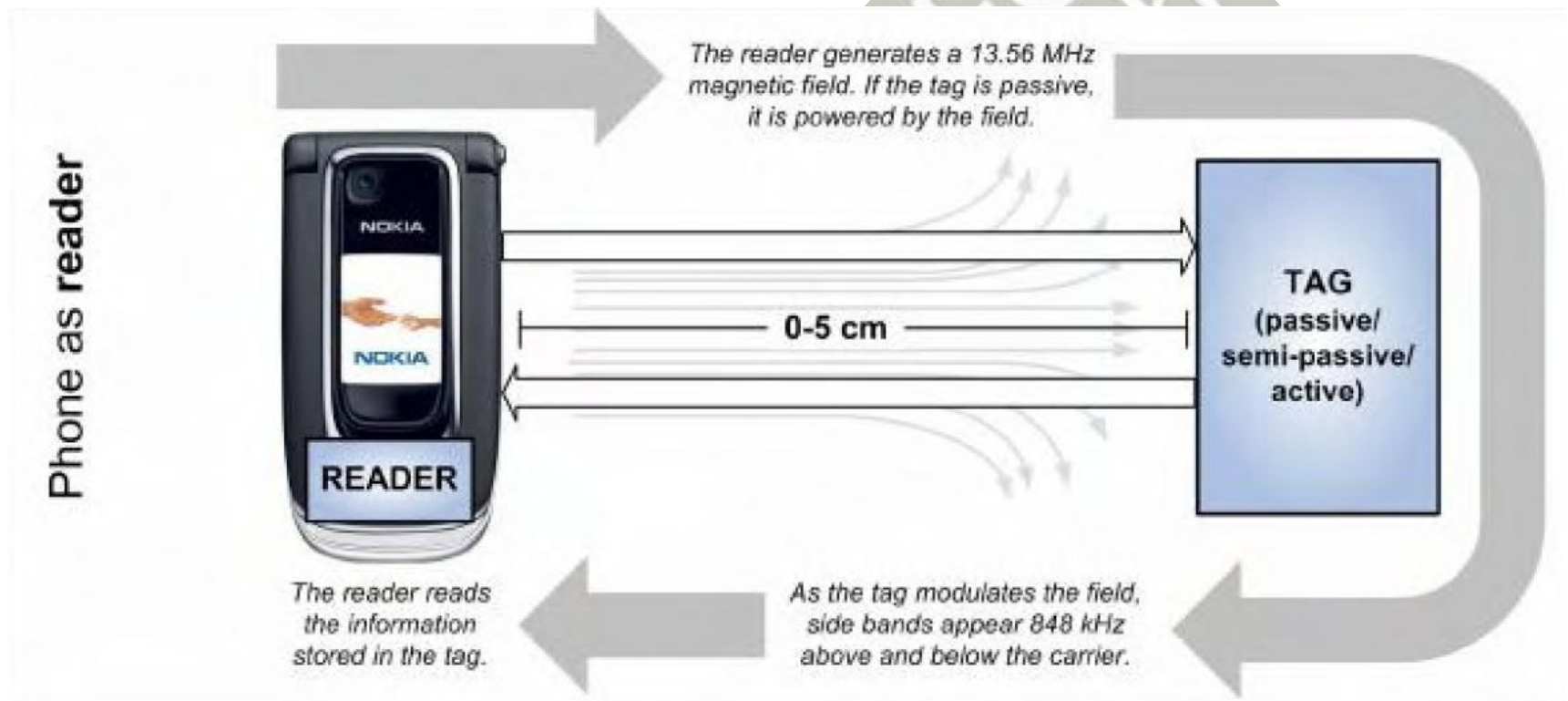
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- Short Range Radio Communication Technology
- Communication starts when two NFC-compatible devices brought together less than four centimeters
- Max. Speed: 424Kbits/sec
- By 2011 NFC-enabled mobile phones are expected to reach 500 million worldwide

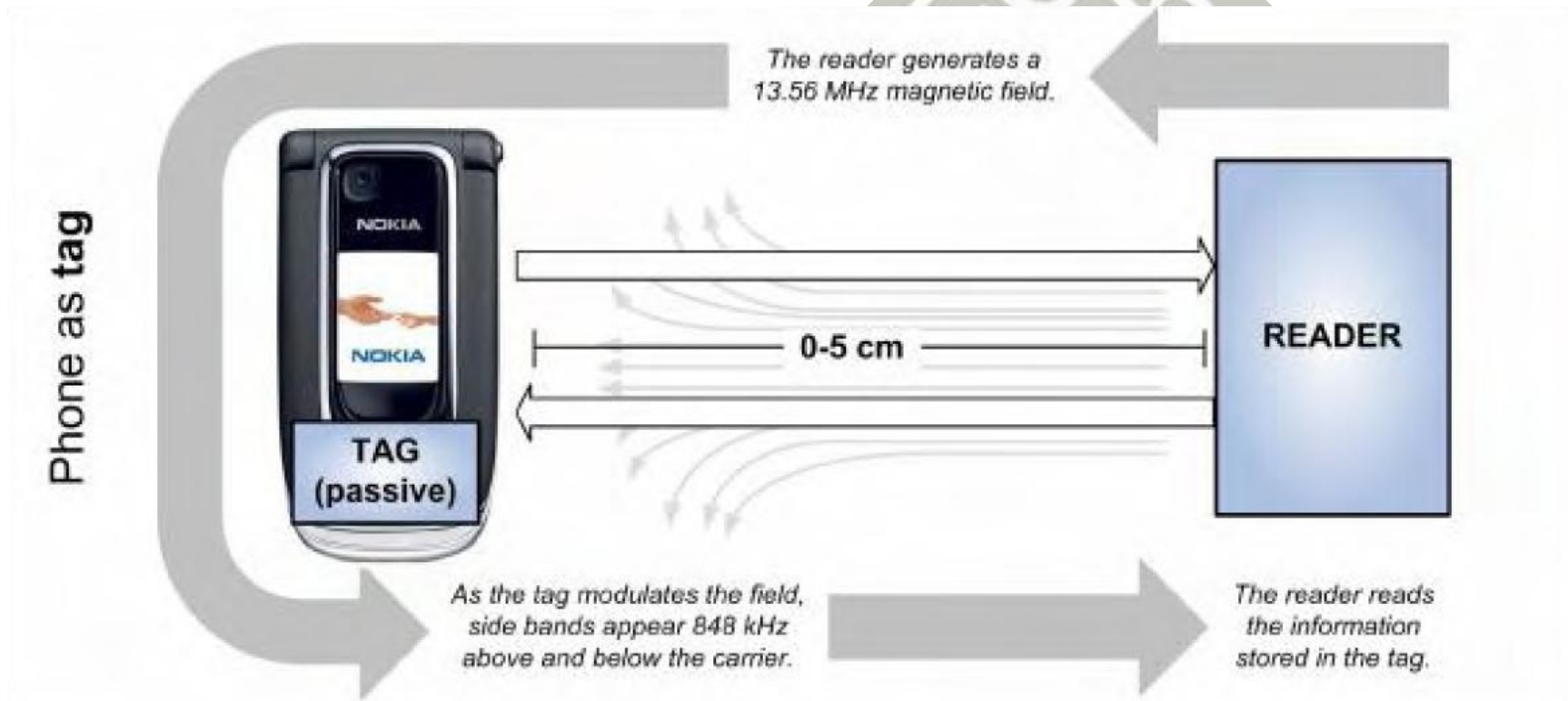
# NFC (Continued)



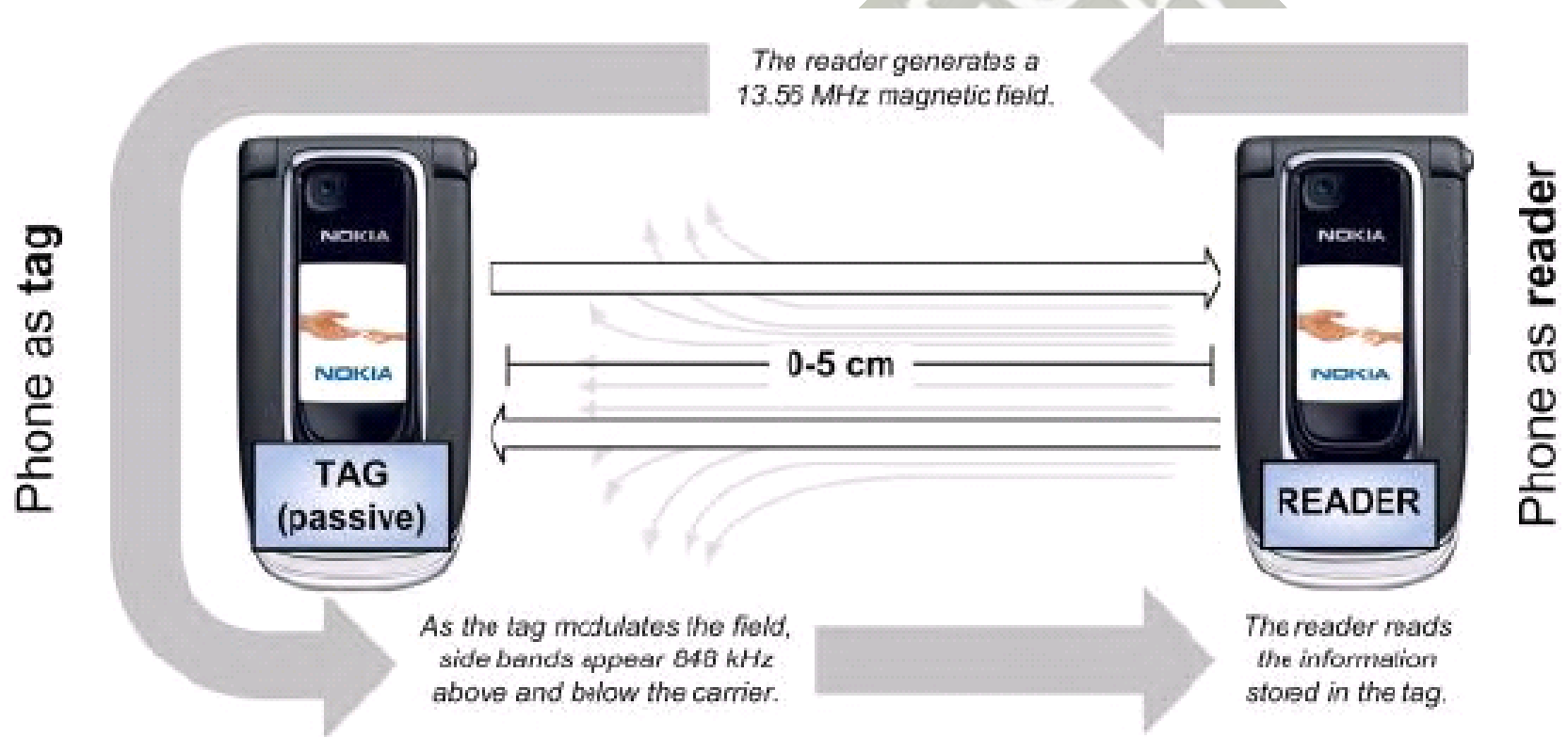
# NFC (Continued)



# NFC (Continued)



# NFC (Continued)



# Advantages of NFC Technology

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- NFC technology can be integrated into mobile phones
- Short range communication
  - ❑ < 4 centimeters
  - ❑ Automatic coupling
  - ❑ Inherent security
  - ❑ Ease of use

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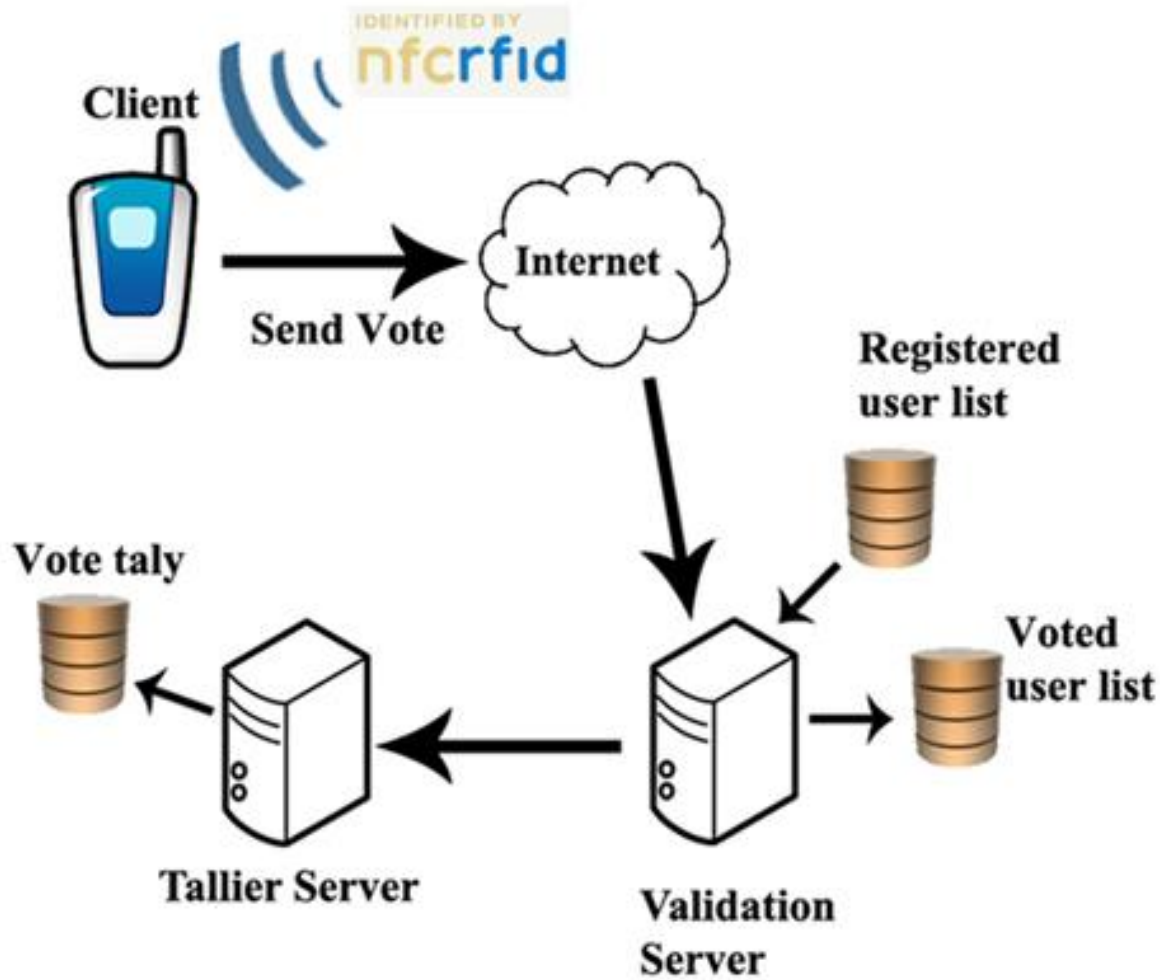
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# NFC Voting Model





# NFC Voting Steps

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1. Voter touches her NFC-enabled device to candidate's NFC tag
    - ❑ NFC Communication starts
  2. Information at the NFC tag is transferred to mobile device
    - ❑ NFC communication ends
  3. User enters private key access code
    - ❑ Midlet encodes vote using user's private key
  4. Vote is transferred to Validator server over Internet
  5. Vote is added to the vote count
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# 1. Voting Room Scenario

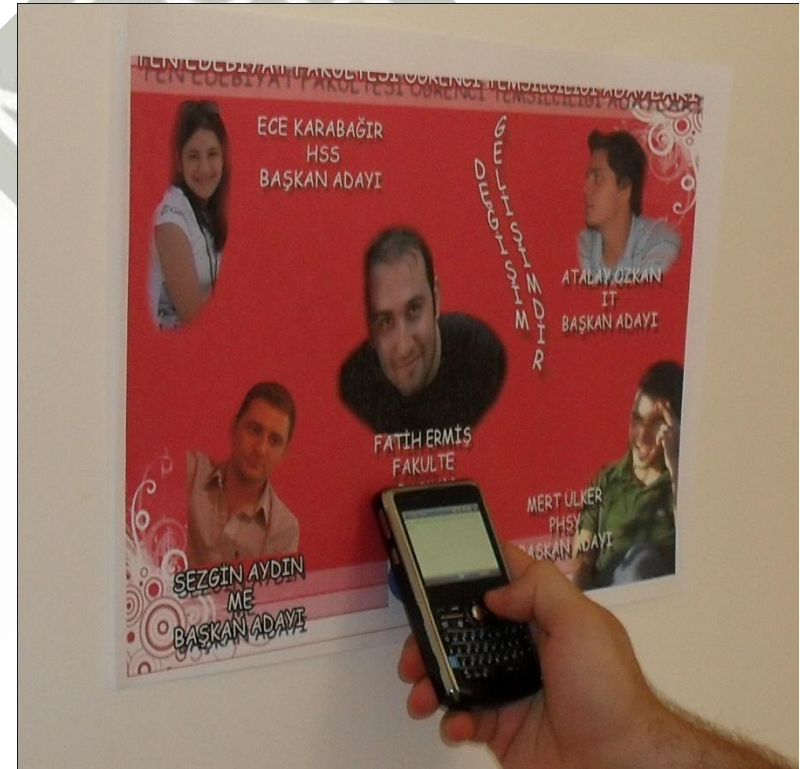
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- Closed room similar to classical voting environment
- Every candidate has plastic stands
- NFC tags are embedded into the plastic stands
- Provides “privacy”



## 2. Poster Scenario

- NFC tags are embedded onto posters
- Provides “ease of use”



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# 3. Promotional Product Scenario

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- NFC tags are embedded into promotional products
- Can provide “privacy” based on its use



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# Experiment Population

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- ❑ 50 undergraduate university students
  - 31 boys
  - 19 girls
- ❑ Ages between 19-26 years

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# Experiment

## Technology usage of attendees (Percentage)

Technology Usage	Percentage
I try to use new technologies	66
I use new technologies when I need	22
I use new technologies when I have to	12



# Experiment (Continued)

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## Chosen Scenarios (Percentage)

Chosen Scenario	Percentage
Voting Room	40
Promotional Product	22
Poster	38

# Experiment (Continued)

## Frequency of Scenario Selection Reason (Percentage)

Scenario Selection Reason	Privacy	Ease of Use	Other
Voting Room	60	35	5
Promotional Product	27	73	0
Poster	0	100	0
Total	30	68	2

# Usability Testing

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- ❑ Industry Usability Reporting Project - 2001 – by NIST
    - Common industry format for usability test reports
  - ❑ Efficiency
    - Objective Metric
    - Measured by: amount of resources expended(e.g. time)
  - ❑ Effectiveness
    - Objective Metric
    - Measured by: Completion rates, Errors
  - ❑ Satisfaction
    - Subjective Metric
    - Users' pleasure while using the system
    - Measured by: Subjective responses of voters
-

# Testing Satisfaction

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- ❑ SUS (System Usability Scale)
- ❑ 10 questions
- ❑ Score contribution between 0-4 is produced for each question
- ❑ Higher score indicates higher usability
- ❑ To test satisfaction NFC voting is compared with web-based voting

# SUS Survey Results

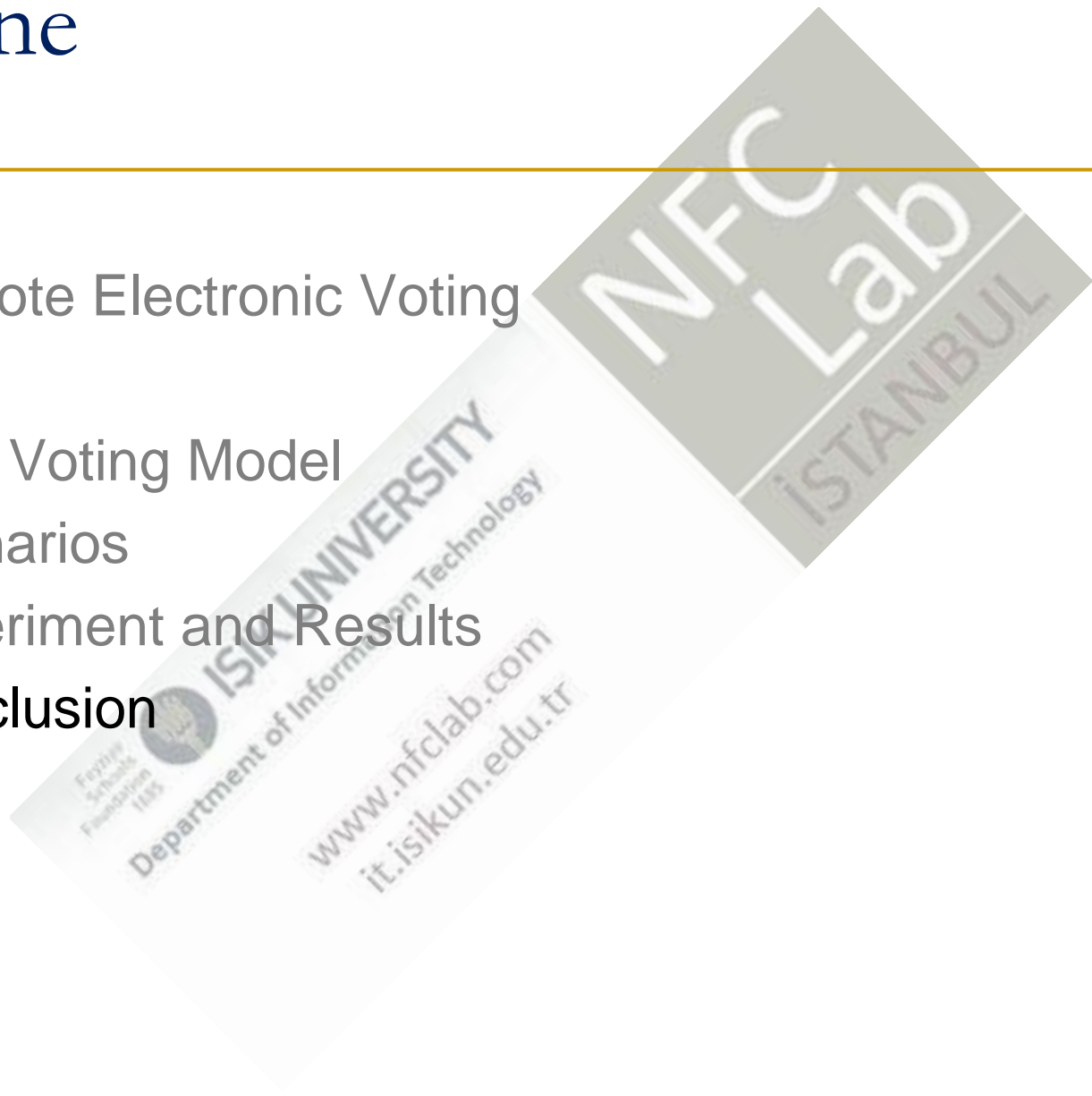
## Scores of SUS Survey (Web-based voting vs. NFC voting)

Questions	Score Contribution
Q1: System use	3.12 / 3.56
Q2: Complexity	3.12 / 3.44
Q3: Ease of use	3.30 / 3.52
Q4: Need for support	3.02 / 2.76
Q5: Integrity	3.04 / 3.54
Q6: Inconsistency	2.96 / 3.48
Q7: Ease of learning to use	3.12 / 3.22
Q8: Cumbersome to use	3.34 / 3.54
Q9: Confidence	3.30 / 3.18
Q10 :Learning a lot of things to get going with system	3.08 / 2.86
<b>SUS Score:(Total Score Contribution * 2.5)</b>	<b>78.50 / 82.75</b>

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# Conclusion

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- ❑ In the context of voting, NFC provided a practical and easy to use environment.
- ❑ NFC technology has a great potential to increase the usability of systems
- ❑ With the rise of NFC-compatible mobile phones, it will bring new opportunities to easiness our lives.



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NFC Lab - ISTANBUL is one of the leading NFC focused research labs in Europe.

NFC Lab - ISTANBUL considers Near Field Communication as an emerging technology that transforms innovative ideas into reality for Future Information and Communication Society.

NFC Lab - ISTANBUL strives for research excellence in focused research areas relevant to NFC. The Lab is aimed to be a catalyst in achieving substantial progress with involvement of key players including MNO, Financial Institutes, Government Agencies, other Research Institutes, Trusted Third Party, other Service Providers.

NFC Lab - ISTANBUL embodies a core team and a network of business and academic partners.

We are committed to work on NFC technologies with multidisciplinary network of expertise all around the world. The core team is accountable for creating and maintaining the business and academic partnerships and dynamically generates networks on project basis.

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Kerem Ok from NFCLab presented "Current Benefits and Future Directions of NFC Services" research paper in Cairo, EGYPT in November 4, 2010 ...[read more](#)



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