Transforming poster metrics: a low-cost, privacy-preserving solution to measure engagement of posters

No. 13

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Key findings: Our low-cost, privacy-friendly automated audience tracker for academic posters shows promise in measuring audience engagement.


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Background

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- Scientific posters are vital for sharing research at conferences, but evaluating their impact is challenging.
- Traditional methods like anecdotal feedback or manual people counting[1] lack scalability and quantifiable metrics.
- Manual counting can provide insights but is impractical in crowded poster halls due to the effort involved, limiting the ability to validate improvements in poster design or content.
- Advances in retail people-counting technologies offer solutions but are often costly and raise privacy concerns due to use of cameras and artificial intelligence (AI).[2]
- We present a low-cost, privacy-preserving prototype device to measure engagement with printed posters.
- Our approach aims to provide simple, meaningful metrics on interactions with printed posters, enabling an estimation of interest in poster content and the potential for data-driven improvements in future poster design.

Research

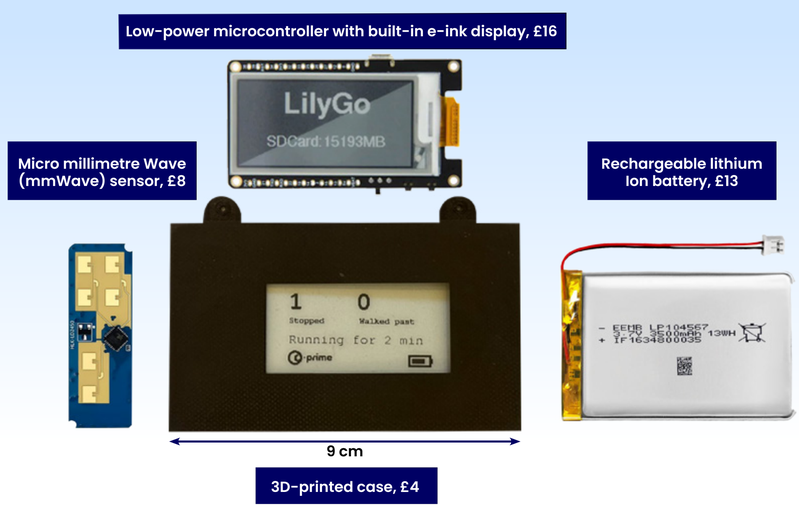
- Research was conducted to identify existing products and emerging technologies, focusing on retail and smart home industries, to assess their suitability for measuring audience engagement in a poster hall.
- Key features considered included privacy, ease of deployment, and accuracy in tracking engagement.

Scan the QR code to view a comparison matrix of technologies evaluated on the digital poster

Development

- A millimetre wave (mmWave)-based sensor was chosen for prototype development because of its favourable balance of features: low cost, high privacy, small size, and ability to track multiple people, including stationary individuals (Figure 1).
- The sensor was paired with a low-power microcontroller for processing and a power-efficient e-ink display to show results.
- Total cost of the prototype was approximately £41.

Figure 1. Size, components and component costs for the prototype device



Evaluation Methodology

- We conducted tests of the prototype in a simulated poster hall environment with each test conducted over 15 minutes (Table 1).
- We focused on recording two key metrics during testing: number of people walking past and number of people who engaged with the poster (estimated as stopping at the poster for >5 seconds).

For more information about the testing methodology view the digital poster by scanning the QR code

Table 1. Prototype testing

Test	Scenario	People walking past	People stopping to view
Test 1: Low traffic	One person	16 repetitions from various directions	16 repetitions stopping for more than 5 seconds
Test 2: Medium traffic	Stationary author + single viewer (two people)	16 repetitions from various directions	16 repetitions stopping for more than 5 seconds
Test 3: High traffic	Three people at same time	20 repetitions from various directions	20 repetitions stopping for more than 5 seconds

Results

- The prototype had high detection accuracy in low- and medium-traffic scenarios under simulated poster hall conditions (Table 2).

Table 2. Actual engagement versus engagement counted by the device

	Actual (n)	Recorded (n)	Detection accuracy (%)
People who stopped			
Test 1: Low traffic	16	16	100
Test 2: Medium traffic	16	18	88
Test 3: High traffic	60	25	42
People who walked past			
Test 1: Low traffic	16	16	100
Test 2: Medium traffic	16	19	81
Test 3: High traffic	60	26	43

Detection accuracy was calculated as 1 – (absolute error/number of expected events) × 100.

- The sensor double-counted the “presenter” in a small proportion of medium-traffic tests.
- The sensor was unable to accurately count all people in the simulated high traffic environment.

For a more detailed breakdown of the results and the calculations used view the digital poster by scanning the QR code

Limitations

- To date we have not tested the prototype in a live poster hall environment, which may affect the generalizability of our findings.

Conclusions

- We built a prototype using mostly off-the-shelf components and our own proprietary software for a low cost of approximately £41 per device.
- The prototype showed 100% accuracy in low traffic and 81% in medium traffic, but dropped to 43% in high traffic, indicating further development is needed for crowded environments.
- The prototype occasionally missed individuals walking past but had few false positives, suggesting it is still valuable for comparing conversion rates of passersby to readers and evaluating the impact of poster content and design changes.
- Future work aims to improve accuracy in high traffic scenarios using new mmWave sensors capable of tracking more individuals.
- Implementation of sensors in a real poster hall would allow measurement of in-person reach and engagement, complementing metrics from digital posters and supporting data-driven approaches to dissemination and communication of scientific research.

References

1. Goodhand JR, et al. *Clin Med (Lond)*. 2011;11:138–141.
2. Gregorczuk H. *Law Technol Hum*. 2022;4:63–78.

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Conflict of interest: All authors are employees of Prime.

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