

Supplementary Informaton

Smartphone-integrated low-cost, reagent-free, non-destructive dried blood spot-based paper sensor for hematocrit measurement

Smriti Sinha,^a Akashlina Basu,^a Jai Shukla,^a Shirin Dasgupta^b, Gorachand Dutta,^a and Soumen Das^{*a}

^aSchool of Medical Science & Technology, IIT Kharagpur - 721302, West Bengal, India

^bDr. B.C. Roy Multispeciality Medical Research centre, IIT Kharagpur-721302, West Bengal

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Table: S1, S2,S3, S4

Corresponding Author:

Prof. Soumen Das,

Email – sou@smst.iitkgp.ac.in, Contact - +91 9475220899

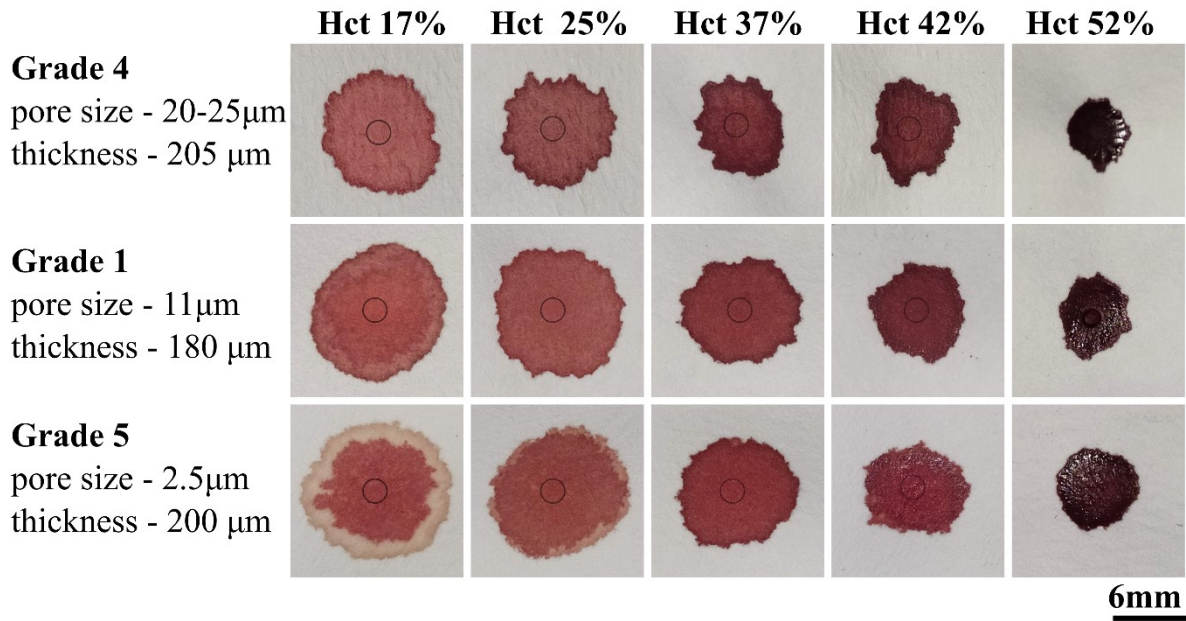


Fig. S1 Image of the spreading area of blood (Hct range: 17-52%) on various grades of Whatman filter paper. Due to their smaller pore size (i.e., 2.5 μ m) than the average size of RBCs (i.e., 7-8 μ m), Grade 5 filter paper slows down the flow of RBCs while plasma moves freely spread to larger areas. Therefore blood spot size seems to be bigger on Grade 5 compared to other examined grades on the studied range of Hct value.

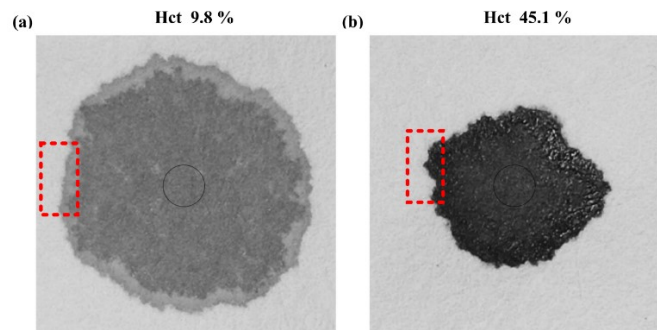


Fig. S2 (a) Grayscale image of dried blood spot with Hct 9.8%, (b) Hct 45.1%, where red dashed rectangle demonstrating the contrast between the edge of ROI and background. More extensive wicking of plasma than RBCs on paper for lower Hct blood reduces the contrast between ROI and background.

Table S1. Properties of filter paper used in this study (1)

Paper Type	Pore Size(μ m)	Flow rate	Thickness (μ m)	Basis weight (g/m ²)	Ash(%)
Grade #1	11	medium	180	87	0.06
Grade #4	25	fast	210	92	0.06
Grade #5	2.5	slow	200	100	0.06

Table S2. Comparison between the result of the automated hematology analyzer (Gold standard method) and the proposed method for measuring blood hematocrit.

S.No	Clinical Hct (%) measured using an automated hematology analyzer	Predicted Hct (%) measured using the proposed device (average \pm st.dev (n=3))	Accuracy(%)
1	9.8	8.58 \pm 0.50	87.55
2	19.7	20.29 \pm 1.20	97.01
3	12.5	11.11 \pm 0.73	88.88
4	15.9	16.28 \pm 1.29	97.61
5	14.7	14.46 \pm 0.86	98.37
6	16.2	15.67 \pm 1.01	96.73
7	17.5	18.48 \pm 1.54	94.40
8	20.1	20.29 \pm 1.09	99.05
9	24.3	23.93 \pm 0.73	98.48
10	21.8	22.09 \pm 1.13	98.67
11	24.4	25.31 \pm 1.63	96.27
12	25.2	25.31 \pm 0.25	99.56
13	27.1	27.52 \pm 1.97	98.45
14	29	27.27 \pm 0.69	94.03
15	30	28.75 \pm 1.17	95.83
16	31.5	30.63 \pm 1.01	97.24
17	32.3	30.20 \pm 0.33	93.50
18	33.5	35.56 \pm 0.58	93.85
19	34.7	35.00 \pm 0.41	99.14
20	35	34.03 \pm 1.09	97.23
21	33	34.51 \pm 1.02	95.42
22	32	32.62 \pm 1.86	98.06
23	32.7	32.10 \pm 1.82	98.17
24	35	37.06 \pm 0.55	94.11
25	36	34.78 \pm 1.09	96.61
26	37	37.92 \pm 1.07	97.51
27	36	37.58 \pm 0.85	95.61
28	35.9	33.74 \pm .27	93.98
29	35.9	35.38 \pm 1.98	98.55
30	36.6	35.17 \pm 0.98	96.09
31	36.8	33.74 \pm 0.16	91.68
32	39	38.18 \pm 0.75	97.90
33	39.8	37.94 \pm 0.83	95.33
34	39.3	41.20 \pm 0.73	95.17
35	38	39.64 \pm 1.10	95.68

36	38.7	39.56 ± 1.59	97.78
37	37.6	37.53 ± 1.31	99.81
38	37.4	38.53 ± 1.58	96.98
39	37.5	37.90 ± 1.03	98.93
40	42.1	41.20 ± 1.11	97.86
41	40.2	40.50 ± 0.67	99.25
42	40.4	41.29 ± 0.90	97.80
43	40	40.72 ± 0.88	98.20
44	41.8	41.65 ± 0.99	99.64
45	41.8	41.07 ± 0.53	98.25
46	41.9	40.67 ± 0.53	97.06
47	42	43.19 ± 0.34	97.17
48	41	42.21 ± 0.91	97.05
49	40.3	40.14 ± 0.76	99.60
50	44.3	43.62 ± 0.15	98.47
51	44.5	46.05 ± 0.77	96.52
52	43.8	42.94 ± 0.75	98.04
53	45	45.85 ± 0.88	98.11
54	42.8	44.45 ± 0.47	96.14
55	43.2	44.74 ± 1.21	96.44
56	42.3	44.21 ± 0.43	95.48
57	42.3	44.50 ± 0.52	94.80
58	45.4	46.37 ± 1.09	97.86
59	42.3	41.93 ± 0.81	99.13
60	46	45.90 ± 0.37	99.78
61	43.3	45.00 ± 1.03	96.07
62	45.8	48.08 ± 0.27	95.02
63	45	48.08 ± 0.01	93.16
64	45.1	47.80 ± 0.18	94.01
65	46.3	47.08 ± 0.47	98.32
66	46.5	48.97 ± 0.31	94.69
67	46.8	49.17 ± 0.35	94.94
68	47.3	48.48 ± 1.13	97.51
69	47.4	47.71 ± 0.59	99.35
70	48	48.39 ± 0.90	99.19
71	49	49.87 ± 0.73	98.22
72	49.5	48.69 ± 1.22	98.36
73	49.6	50.24 ± 0.69	98.71
74	50.3	49.47 ± 0.87	98.35
75	51	51.81 ± 0.92	98.41
76	51.7	52.58 ± 0.66	98.30
77	52.4	51.18 ± 1.07	97.67

78	52.8	51.49 ± 0.78	97.52
79	52.9	50.68 ± 0.21	95.80
80	54	51.92 ± 0.4	96.15
81	53	53.68 ± 0.02	98.72
82	54.8	52.43 ± 0.13	95.68
83	55.4	55.77 ± 0.31	99.33
84	58	57.53 ± 0.87	99.19
85	18.3	16.40 ± 0.47	89.62
86	32.1	32.17 ± 1.57	99.78
87	50.2	48.22 ± 0.44	96.06

Table S3. Estimated Cost analysis of portable photo box

components	quantity	Cost (USD)
Cardboard box	1	0.12
Led light	1	4.37
Styrofoam block	1	0.12
	Total cost	~4.61 (USD)

Table S4. Estimated Manufacturing to commercial adaptation cost per paper sensor

components	Cost (USD)
Whatman filter paper	0.015
Lamination sheet	0.0061
Double-sided adhesive	0.0073
Total cost (technical)	~ 0.03 (USD)
Additional cost (pilot research and commercial adaptation) @50% per test	~0.015 (USD)
Cost (Per test)	~0.045(USD)

References

1. Whatman Filter Paper Grades Guide | Cytiva [Internet]. [cited 2023 Jun 17]. Available from: <https://www.cytivalifesciences.com/en/us/solutions/lab-filtration/knowledge-center/a-guide-to-whatman-filter-paper-grades>