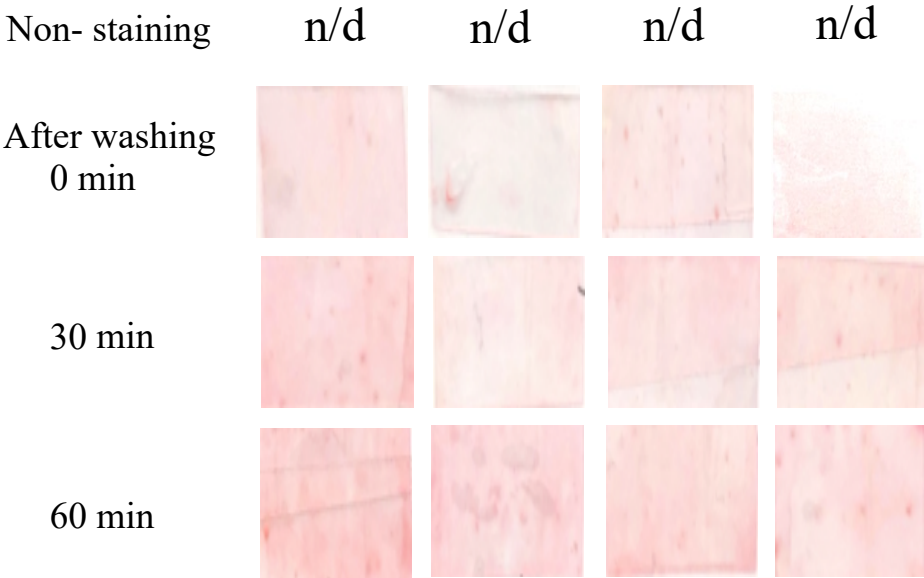
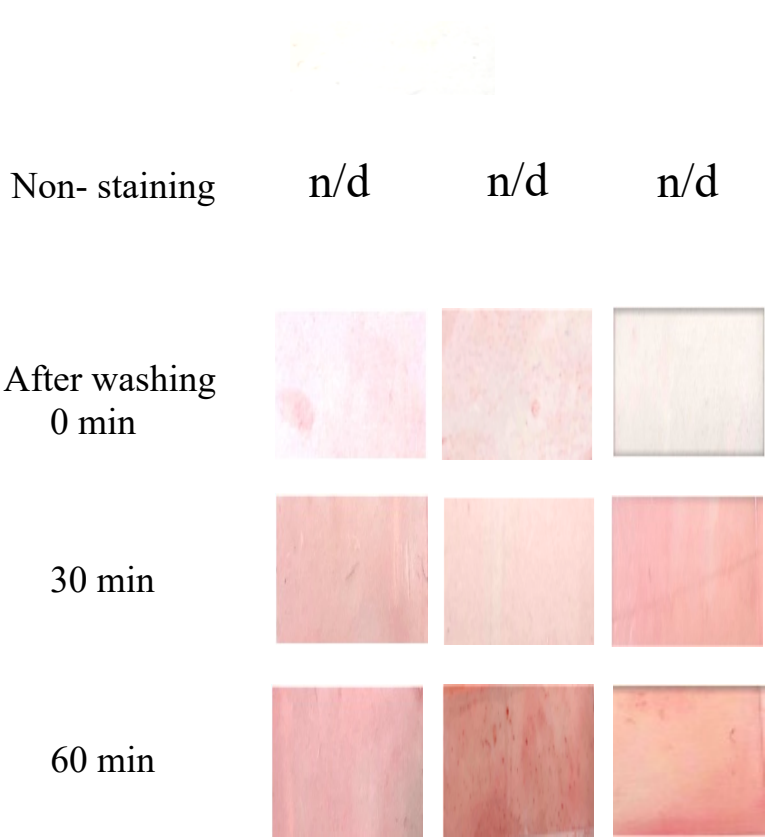


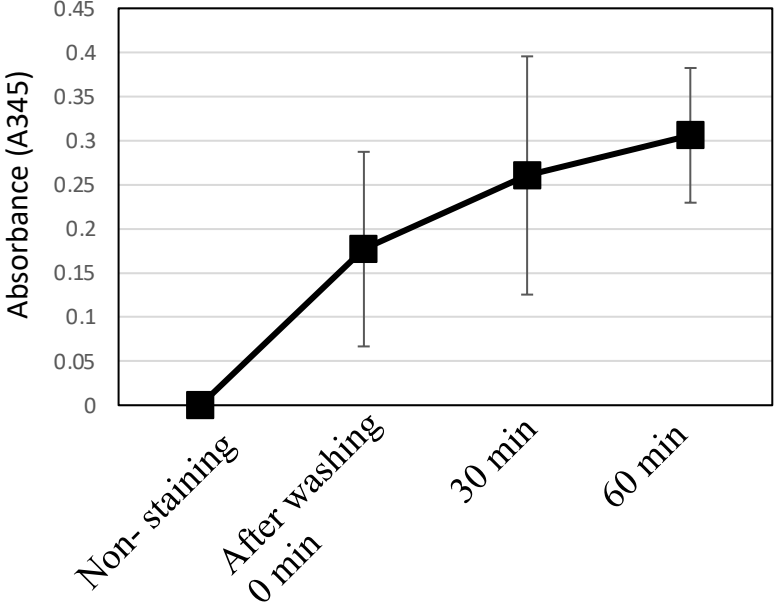
Supplementary Figure 1



# Supplementary Figure 2

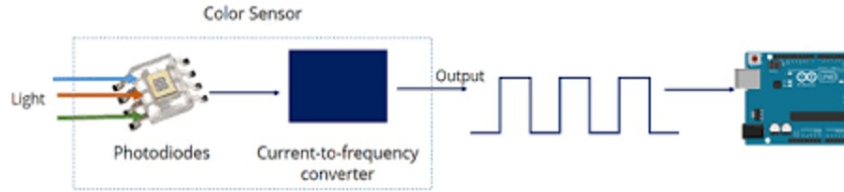
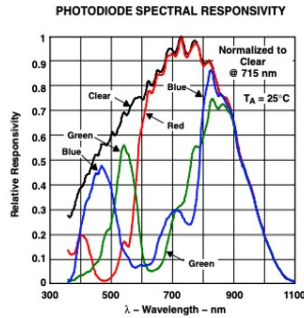


Supplementary Figure 3



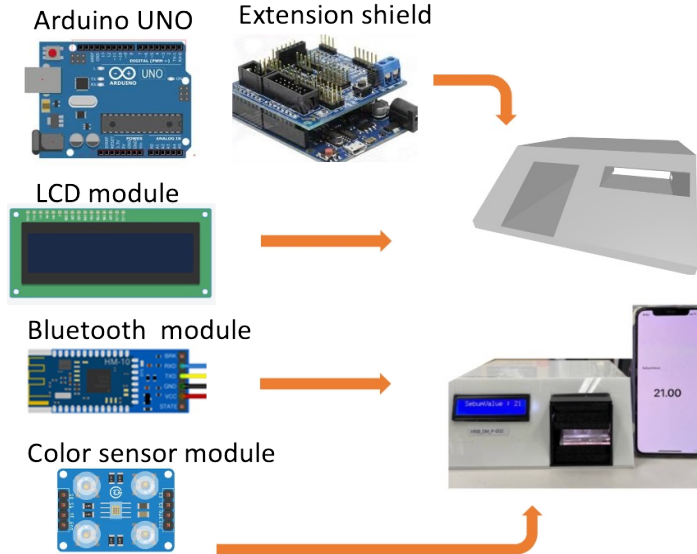
# Supplementary Figure 4

(a)



(b)

Color sensor device components



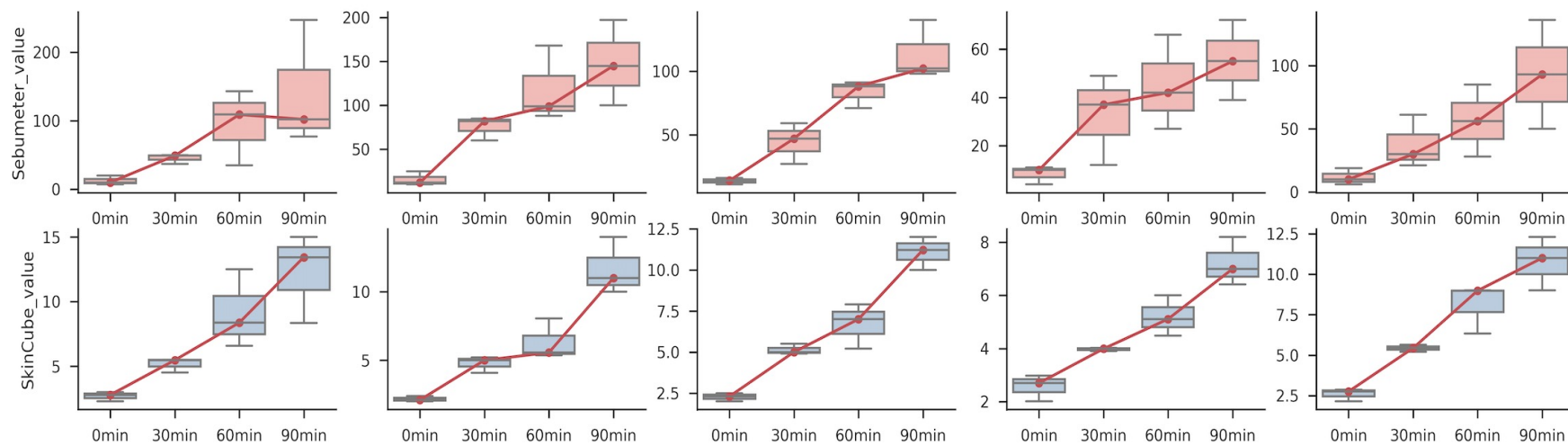
Smartphone app



Color sensor platform components price

Color sensor platform components	Price
Arduino UNO	\$ 24.95
LCD module	\$ 15.00
Bluetooth module	\$ 10.00
Color sensor module	\$ 24.00
Extension shield	\$ 7.00

# Supplementary Figure 5



Supplementary Table 1

<b>Participants</b>	<b>Sex</b>	<b>Age</b>	<b>Skin type</b>	<b>Skin disease</b>
PM1	male	45	oily	N
PM2	male	35	oily	N
PF1	female	29	dry	N
PF2	female	30	oily	N
PM3	male	45	oily	N
PM4	male	35	oily	N
PF3	female	30	oily	N
PS1	male	44	dry	N
PS2	male	38	oily	N
PS3	female	32	oily	N
PS4	female	28	dry	N
PS5	male	46	oily	N

Supplementary Table 2

Measuring platform	Sebum replace time	PS1				PS2				PS3				PS4				PS5			
		Intensity	Average	SD	R <sup>2</sup>	Intensity	Average	SD	R <sup>2</sup>	Intensity	Average	SD	R <sup>2</sup>	Intensity	Average	SD	R <sup>2</sup>	Intensity	Average	SD	R <sup>2</sup>
Sebumeter	After washing 0 min	20			0.99	12			0.98	14			0.998	10			0.97	10			0.98
		10	12.33	6.09		25	15.67	7.28		16	13.67	2.52		11	8.33	3.39		19	11.67	6.66	
		7				10				11				4				6			
	30 min	37				60				27				37				21			
		49	45.33	7.23		85	75.67	12.21		59	44.33	16.17		49	32.67	16.88		61	37.33	18.77	
		50				82				47				12				30			
	60 min	35				99				91				42				28			
		143	95.67	49.39		168	118.33	38.78		88	83.33	10.79		66	45.00	17.60		85	56.33	28.50	
		109				88				71				27				56			
	90 min	77				145				98				55				50			
		247	142.00	82.10		197	147.33	43.42		140	113.33	23.18		72	55.33	14.76		136	93.00	43.00	
		102				100				102				39				93			
Color sensor device	After washing 0 min	2.78			0.99	2.1			0.94	2.5			0.94	2.98			0.99	2.15			0.99
		2.99	2.68	0.33		2	2.17	0.19		2	2.27	0.25		2.01	2.56	0.45		2.87	2.59	0.39	
		2.28				2.4				2.3				2.7				2.76			
	30 min	4.5				5				5.5				3.9				5.65			
		5.5	5.16	0.51		4.07	4.76	0.54		4.9	5.13	0.32		3.99	3.97	0.06		5.44	5.44	0.22	
		5.47				5.2				5				4.02				5.22			
	60 min	6.57				5.56				7				5.11				6.33			
		12.5	9.15	2.72		5.37	6.33	1.34		5.2	6.70	1.37		6.01	5.20	0.68		8.99	8.11	1.54	
		8.37				8.05				7.9				4.49				9			
	90 min	8.35				10				10				7				9			
		15	12.26	3.11		14	11.67	1.86		12	11.07	1.01		8.2	7.21	0.81		11	10.77	1.66	
		13.44				11				11.22				6.42				12.3			

Supplementary Table 3

Detection contents	Methods of assement							
	Solvent	Absorbent pad	Bentoite clay	Sebutape	Sebumeter	Lipometer	Sebifix	ORO-stained methods
Casual sebum level	✓				✓	✓		✓
Sebum excretion rate	✓	✓			✓	✓		✓
Instant sebum delivery				✓			✓	✓
Follicular excretion rate				✓			✓	
Glandular parameter				✓			✓	



# Supplementary material

```
#include <LiquidCrystal_I2C.h>
#include <SoftwareSerial.h>
#include <Wire.h>

#define S0 4
#define S1 5
#define S2 6
#define S3 7
#define sensorOut 8

LiquidCrystal_I2C lcd (0x27, 20, 4);
SoftwareSerial BTSerial(3,2);

// Stores frequency read by the photodiodes
const int numReadings = 10;

double redFrequency = 0;
double greenFrequency = 0;
double blueFrequency = 0;
```

```
// Stores the red. green and blue colors
```

```
double redColor = 0;
```

```
double greenColor = 0;
```

```
double blueColor = 0;
```

```
//calibration
```

```
int redMin = 15;
```

```
int redMax = 255;
```

```
int greenMin = 16;
```

```
int greenMax = 255;
```

```
int blueMin = 13;
```

```
int blueMax = 255;
```

```
double SebumValue = 0;
```

```
int repeat = 200;
```

```
void setup()
{
  // Begins serial communication
  lcd.begin(16, 2);
  Serial.begin(9600);
  BTSerial.begin(9600);

  pinMode(S0, OUTPUT);
  pinMode(S1, OUTPUT);
  pinMode(S2, OUTPUT);
  pinMode(S3, OUTPUT);

  // Setting the sensorOut as an input
  pinMode(sensorOut, INPUT);
```

```
// Setting frequency scaling to 20%
```

```
digitalWrite(S0,HIGH);
```

```
digitalWrite(S1,LOW);
```

```
lcd.init();
```

```
lcd.backlight();
```

```
lcd.setCursor(0,0);
```

```
lcd.print("Hello HuNBiome");
```

```
lcd.setCursor (0,1);
```

```
lcd.print("I'm sebum reader");
```

```
Serial.println("Hello HuNBiome");
```

```
Serial.println("I'm sebum reader");
```

```
delay(3000);
```

```
//lcd connection  
lcd.clear();  
Serial.println("Cleared!");  
double sumSV = 0;  
double meanSV = 0;  
  
for (int i=0; i<=repeat; i=i+1)  
{  
// Setting RED (R) filtered photodiodes to be  
read  
digitalWrite(S2,LOW);  
digitalWrite(S3,LOW);
```

```
// Reading the output frequency
redFrequency = pulseIn(sensorOut, LOW);
redColor = map(redFrequency, redMin,
redMax, 255, 0);

// Setting GREEN (G) filtered photodiodes to
be read
digitalWrite(S2,HIGH);
digitalWrite(S3,HIGH);

// Reading the output frequency
greenFrequency = pulseIn(sensorOut, LOW);
greenColor = map(greenFrequency, greenMin,
greenMax, 255, 0);
```

```
digitalWrite(S2,LOW);
```

```
digitalWrite(S3,HIGH);
```

```
// Reading the output frequency
```

```
blueFrequency = pulseIn(sensorOut, LOW);
```

```
blueColor = map(blueFrequency, blueMin,  
blueMax, 255, 0);
```

```
SebumValue = redColor-
(greenColor+blueColor)/2;
    sumSV = sumSV + SebumValue;
    Serial.println(i);
    Serial.println(SebumValue);
    Serial.println();
}
meanSV = sumSV / repeat;
Serial.println("sumSV");
Serial.println(sumSV);
Serial.println("meanSV");
Serial.println(meanSV);
Serial.println();
Serial.println();
```



```
lcd.init();
```

```
  lcd.backlight();
```

```
  lcd.setCursor(0,0);
```

```
  lcd.print("Hello HuNBiome");
```

```
  lcd.setCursor(0,1);
```

```
  lcd.print("I'm sebum reader");
```

```
Serial.println("Hello HuNBiome");
```

```
Serial.println("I'm sebum reader");
```

```
// Bluetooth

if (BTSerial.available()) {
  Serial.println(SebumValue);
}

lcd.clear();
lcd.setCursor(0,0);
lcd.print(" Sebum : ");
lcd.print(meanSV, 2);
lcd.setCursor(0,1);
lcd.print(" Reset for new");
}

void loop() {
}
```