

The Education University of Hong Kong

2021-2022 Quality Education Fund Thematic Network – Tertiary Institutes

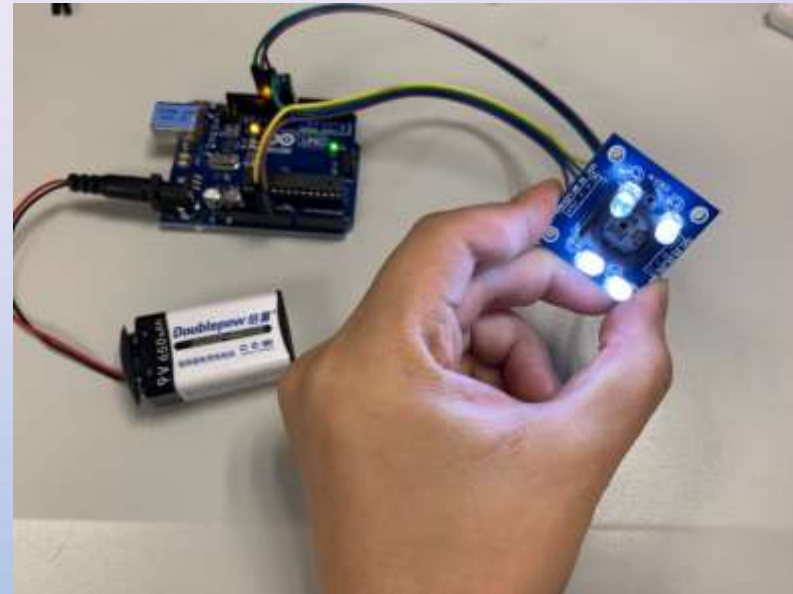
STEM Project Team

SCHOOL: CHRISTIAN AND MISSIONARY ALLIANCE SUN
KEI SECONDARY SCHOOL (S4)

TOPIC: REFLECTIVE COLOUR SENSING WITH RGB
COLOUR SENSOR

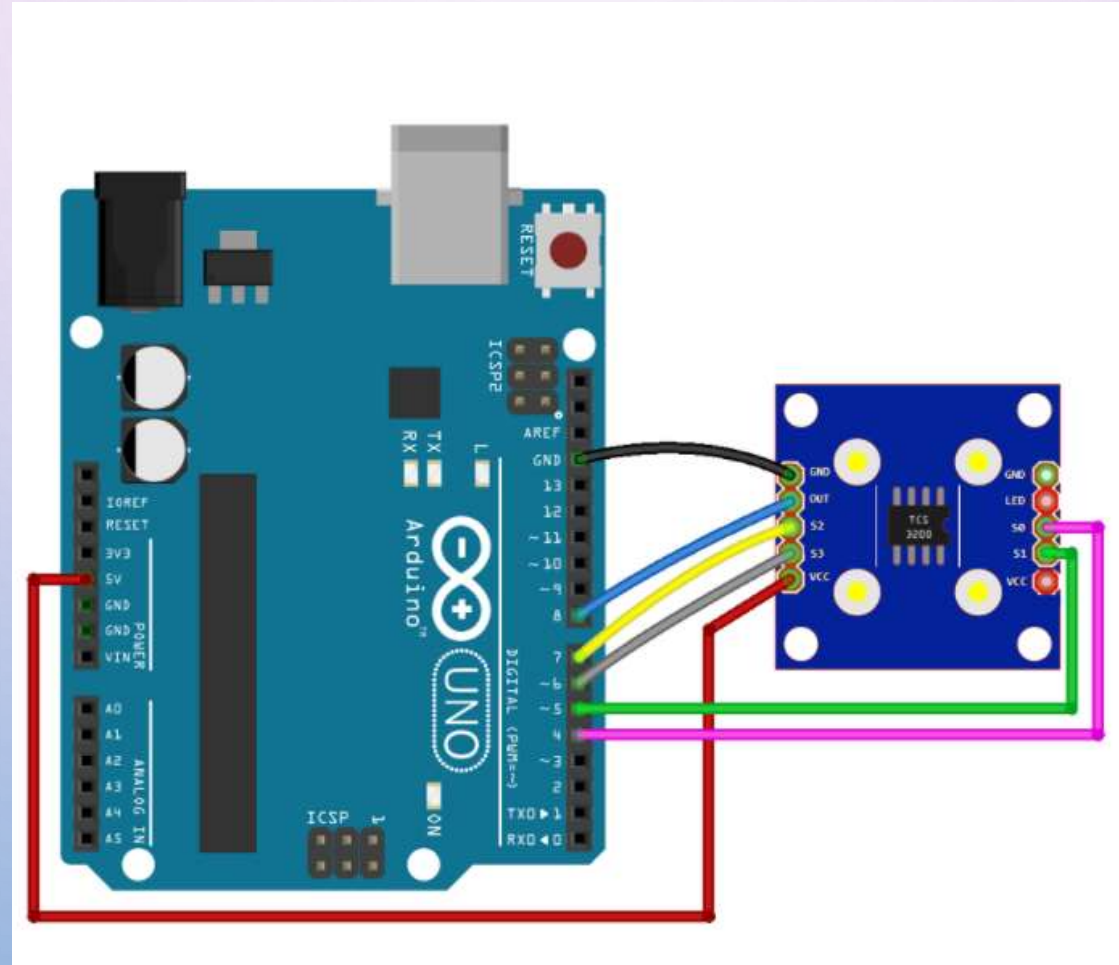
2

COLOR SENSOR – TCS230

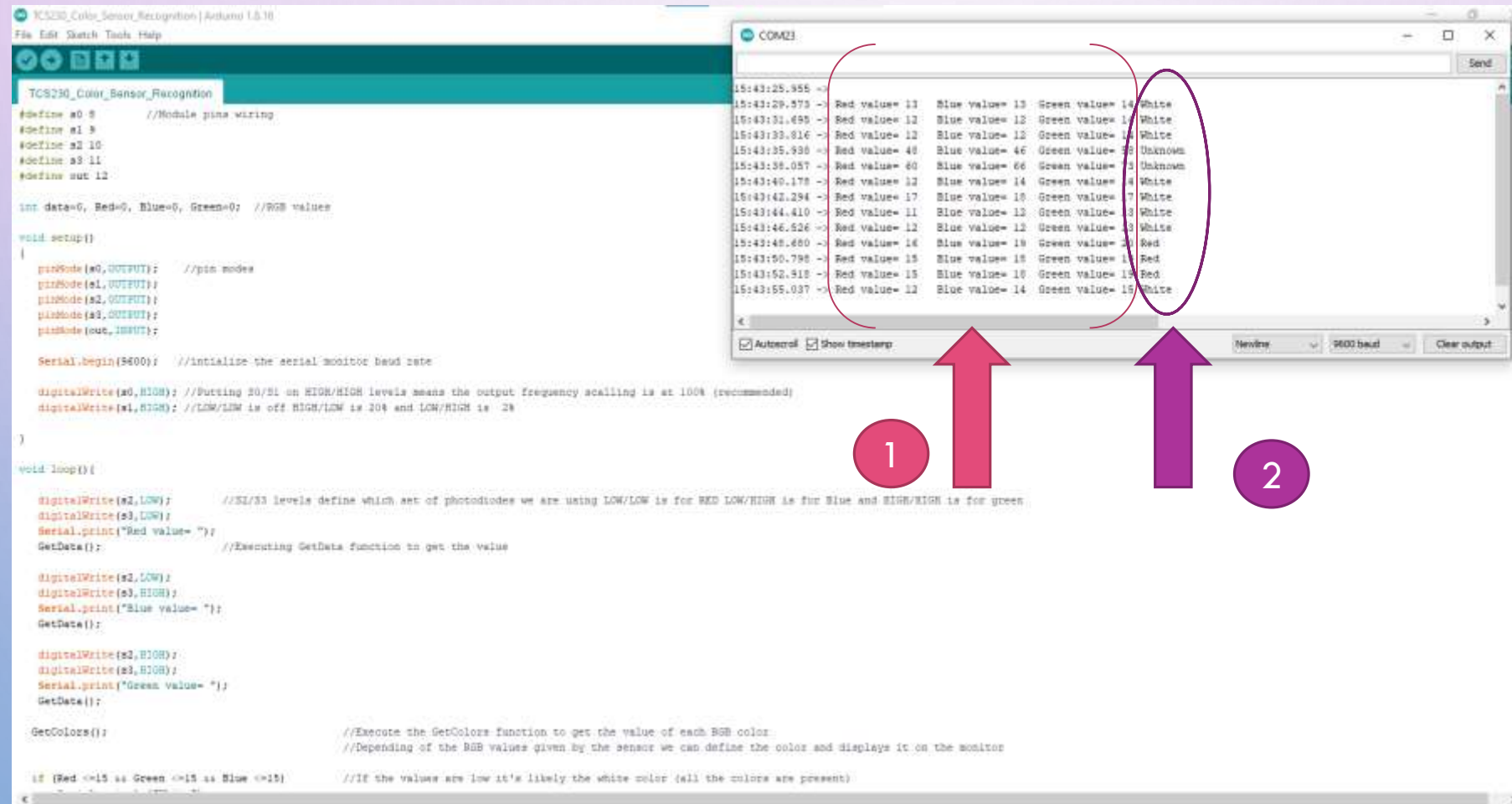




CIRCUIT



COLOR SENSOR RECOGNITION



```

TCS230_Color_Sensor_Recognition | Arduino 1.8.10
File Edit Sketch Tools Help

TCS230_Color_Sensor_Recognition

#define a0 9 //Module pin wiring
#define a1 9
#define a2 10
#define a3 11
#define out 12

int data=0, Red=0, Blue=0, Green=0; //RGB values

void setup()
{
  pinMode(a0,OUTPUT); //pin modes
  pinMode(a1,OUTPUT);
  pinMode(a2,OUTPUT);
  pinMode(a3,OUTPUT);
  pinMode(out,INPUT);

  Serial.begin(9600); //initialize the serial monitor baud rate

  digitalWrite(a0,HIGH); //Putting 20/21 on HIGH/HIGH levels means the output frequency scaling is at 100% (recommended);
  digitalWrite(a1,HIGH); //LOW/LOW is off HIGH/LOW is 20% and LOW/HIGH is 2%
}

void loop() {

  digitalWrite(a2,LOW); //21/23 levels define which set of photodiodes we are using LOW/LOW is for RED LOW/HIGH is for Blue and HIGH/HIGH is for green.
  digitalWrite(a3,LOW);
  Serial.print("Red value= ");
  GetData(); //Executing GetData function to get the value

  digitalWrite(a2,LOW);
  digitalWrite(a3,HIGH);
  Serial.print("Blue value= ");
  GetData();

  digitalWrite(a2,HIGH);
  digitalWrite(a3,HIGH);
  Serial.print("Green value= ");
  GetData();

  GetColors(); //Execute the GetColors function to get the value of each RGB color.
  //Depending of the RGB values given by the sensor we can define the color and displays it on the monitor

  if (Red <=15 || Green >=15 || Blue >=15) //If the values are low it's likely the white color (all the colors are present)
  
```

COM3
 15:43:25.955 ->
 15:43:29.975 -> Red value= 13 Blue value= 13 Green value= 14 White
 15:43:31.455 -> Red value= 12 Blue value= 12 Green value= 14 White
 15:43:33.816 -> Red value= 12 Blue value= 12 Green value= 14 White
 15:43:35.936 -> Red value= 48 Blue value= 46 Green value= 56 Unknown
 15:43:38.057 -> Red value= 40 Blue value= 66 Green value= 5 Unknown
 15:43:40.178 -> Red value= 12 Blue value= 14 Green value= 4 White
 15:43:42.294 -> Red value= 17 Blue value= 10 Green value= 7 White
 15:43:44.410 -> Red value= 11 Blue value= 12 Green value= 8 White
 15:43:46.526 -> Red value= 12 Blue value= 12 Green value= 8 White
 15:43:48.660 -> Red value= 16 Blue value= 19 Green value= 26 Red
 15:43:50.798 -> Red value= 15 Blue value= 18 Green value= 18 Red
 15:43:52.918 -> Red value= 15 Blue value= 10 Green value= 19 Red
 15:43:55.037 -> Red value= 12 Blue value= 14 Green value= 15 White

1 (Red value= 13) 2 (Green value= 14)



CODE

```

TC0210_Color_Sensor_Perception [Arduino 1.8.16]
File Edit Sketch Tools Help

TC0210_Color_Sensor_Perception
//Module pins wiring
#define a0 0
#define a1 9
#define a2 18
#define a3 11
#define a4 22

int data=0, Red=0, Blue=0, Green=0; //RGB values

void setup()
{
  pinMode(a0, OUTPUT); //pin modes
  pinMode(a1, OUTPUT);
  pinMode(a2, OUTPUT);
  pinMode(a3, OUTPUT);
  pinMode(a4, OUTPUT);

  Serial.begin(9600); //initialize the serial monitor baud rate

  digitalWrite(a0, HIGH); //Turning 3V/5V on HIGH/5VH levels means the output frequency scaling is at 100% (recommended)
  digitalWrite(a1, HIGH); //LOW/L0W is off HIGH/LOW is 24V and LOW/5VH is 3V
}

void loop()
{
  digitalWrite(a0, LOW); //0V/0 levels define which set of photodiodes we are using LOW/LOW is for RED LOW/HIGH is for Blue and HIGH/HIGH is for green
  digitalWrite(a1, LOW);
  Serial.print("Red value=");
  GetData(); //Executing GetData function to get the value

  digitalWrite(a2, LOW);
  digitalWrite(a3, HIGH);
  Serial.print("Blue value=");
  GetData();

  digitalWrite(a2, HIGH);
  digitalWrite(a3, LOW);
  Serial.print("Green value=");
  GetData();

  digitalWrite(a4, LOW); //Execute the GetData function to get the value of each RGB color
  //Depending of the RGB values given by the sensor we can define the color and display it on the monitor

  if (Red >=15 && Green <=15 && Blue <=15) //If the values are low it's likely the white color (all the colors are present)

```

1

```

TC0210_Color_Sensor_Perception
//Depending of the RGB values given by the sensor we can define the color and display it on the monitor.
//If the values are low it's likely the white color (all the colors are present)
if (Red <=15 && Green <=15 && Blue <=15)
  Serial.println("White");

else if (Red >=15 && Green <=15 && Blue <=15) //If Red value is the lowest one and smaller than 15 it's likely Red
  Serial.println("Red");

else if (Blue >=15 && Red <=15 && Green <=15) //Same thing for Blue
  Serial.println("Blue");

else if (Green >=15 && Red <=15 && Blue <=15) //Green is the highest value, so we do it using the same method as above (the lowest), but here I used a reflexive check
  Serial.println("Green"); //Which means the blue value is very low too, so I decided to check the difference between green and blue and see if it's acceptable

else
  Serial.println("Unknown"); //If the color is not recognized, you can add as many as you want

delay(2000); //It's okay you can modify it if you want

}

void GetData()
{
  digitalWrite(a0, LOW); //Until "low" on LOW, we start measuring the duration and stops when "low" is HIGH again
  Serial.println(a0); //It's a duration measured, which is related to frequency as the sensor gives a frequency depending on the color.
  delay(200); //The higher the frequency the lower the duration.

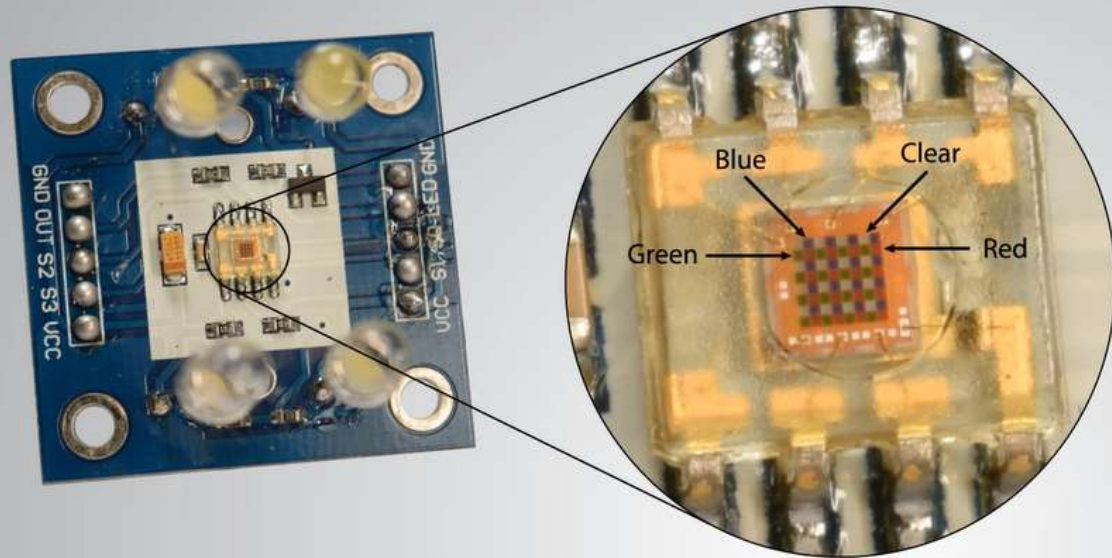
}

void GetData2()
{
  digitalWrite(a1, LOW); //0V/0 levels define which set of photodiodes we are using LOW/LOW is for RED LOW/HIGH is for Blue and HIGH/HIGH is for green
  digitalWrite(a2, LOW); //Here we wait until "low" go LOW, we start measuring the duration and stops when "low" is HIGH again, if you have trouble with this expression check the bottom of the code
  Red = pulseIn(a1, HIGH); //The higher the frequency the lower the duration
  digitalWrite(a2, HIGH); //Here we select the other color (any of photodiodes) and measure the color value using the same technique
  delay(200);
  Blue = pulseIn(a2, HIGH);
  digitalWrite(a3, LOW);
  Green = pulseIn(a3, HIGH);
  Serial.println(a3);
  delay(200);
}

```

2

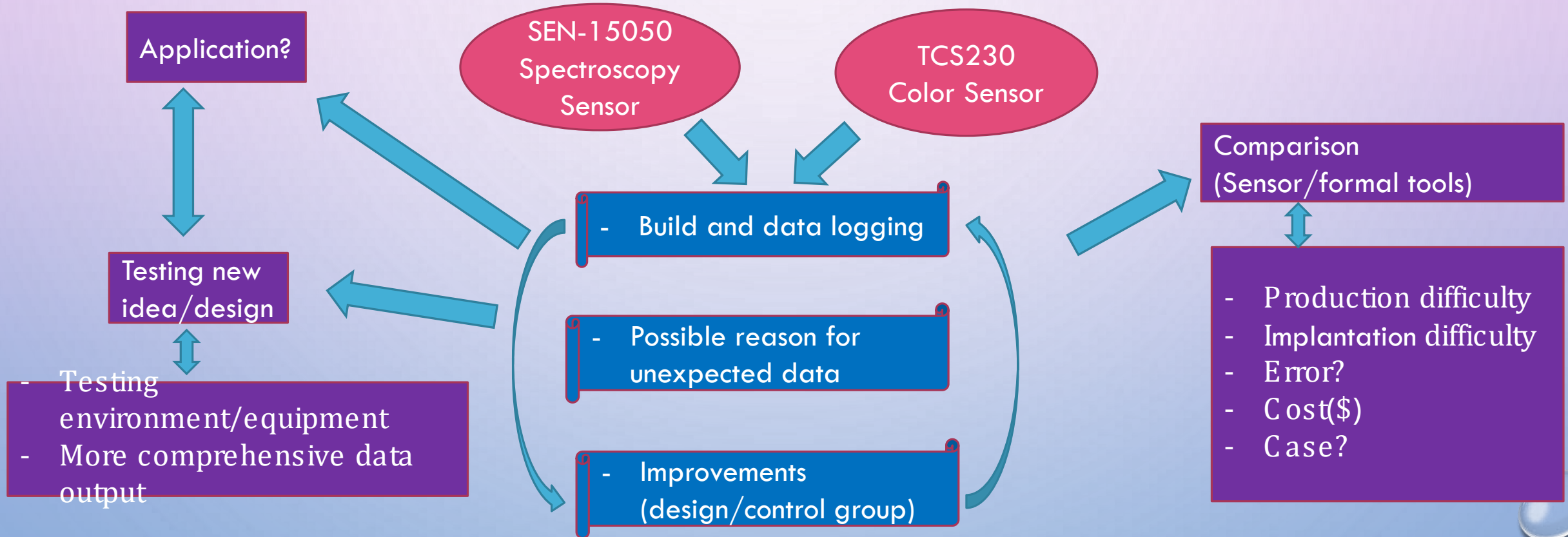
NOTES



2

| Color Chart | R | G | B | Color Name |
|-------------|-----|-----|-----|--------------|
| ■ ■ ■ | 0 | 0 | 0 | Black |
| ■ ■ ■ | 255 | 255 | 255 | White |
| ■ ■ ■ | 224 | 224 | 224 | Light Gray |
| ■ ■ ■ | 128 | 128 | 128 | Gray |
| ■ ■ ■ | 64 | 64 | 64 | Dark Gray |
| ■ ■ ■ | 255 | 0 | 0 | Red |
| ■ ■ ■ | 255 | 96 | 208 | Pink |
| ■ ■ ■ | 160 | 32 | 255 | Purple |
| ■ ■ ■ | 80 | 208 | 255 | Light Blue |
| ■ ■ ■ | 0 | 32 | 255 | Blue |
| ■ ■ ■ | 96 | 255 | 128 | Yellow-Green |
| ■ ■ ■ | 0 | 192 | 0 | Green |
| ■ ■ ■ | 255 | 224 | 32 | Yellow |
| ■ ■ ■ | 255 | 160 | 16 | Orange |
| ■ ■ ■ | 160 | 128 | 96 | Brown |
| ■ ■ ■ | 255 | 208 | 160 | Pale Pink |

SCIENCE INVESTIGATION/ ENGINEERING DESIGN CYCLE



REFERENCE: MATERIAL LIST(HKD)

Spectroscopy Sensor

SEN-15050 SparkFun Triad Spectroscopy Sensor - AS7265x - ~\$510

Color Sensor

TCS230 - \$52

RGB LED - ~\$2

~~Temperature sensor~~

~~DS18B20 - \$9~~

~~Turbidity~~

~~SEN1089 - \$84.71~~

~~Pasco PS-2002 Graphing Logger + Pasco Passport Ps-2122 Turbidimeter -> \$5000~~

