Interfacing and using Color Sensor with Firebird-V Robot

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IIT Bombay
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Agenda for Discussion

1. Understanding a color sensor
   - What is a color sensor ?
   - Understanding the pin diagram of the color sensor
   - Role of S0 and S1
   - Role of S2 and S3
2. Color sensor setup and application
   - Interfacing the color sensor with Firebird V
   - Steps to identify the color of an object
3. C - code
   - Prerequisites for understanding the code
   - Code

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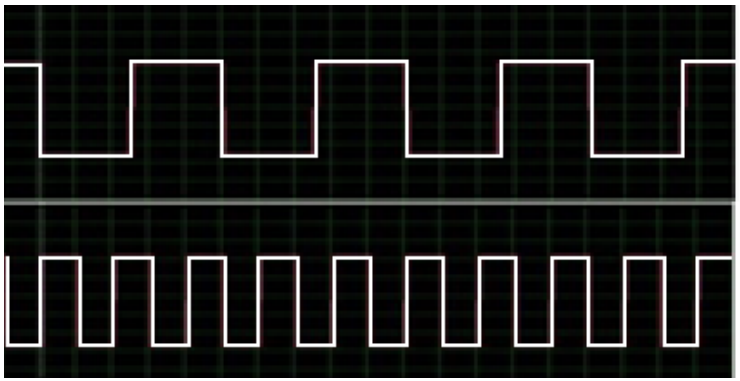

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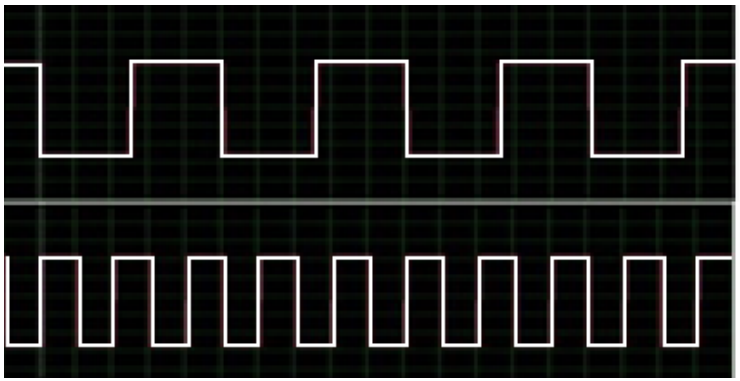

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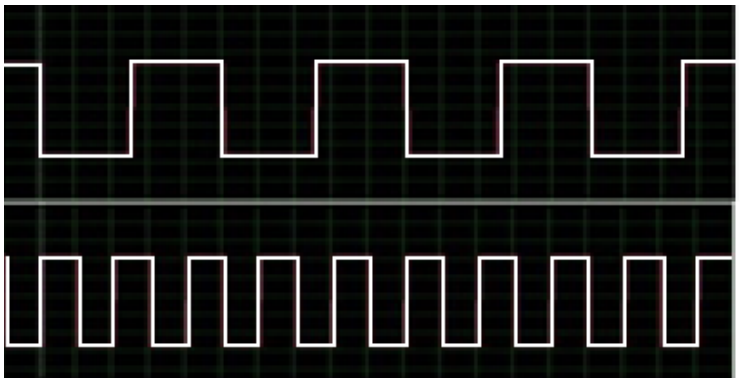

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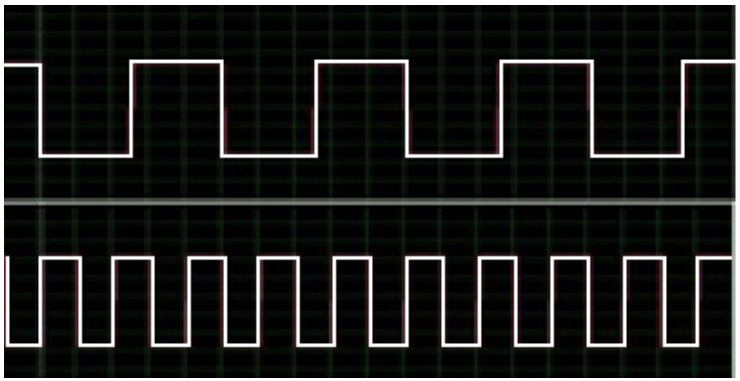

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- Thus on the basis of different frequencies we can identify the colors using the color sensor.

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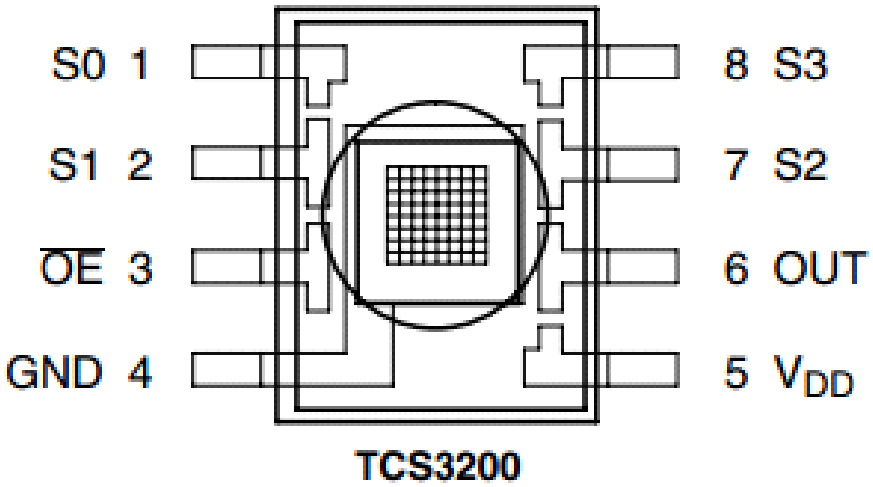

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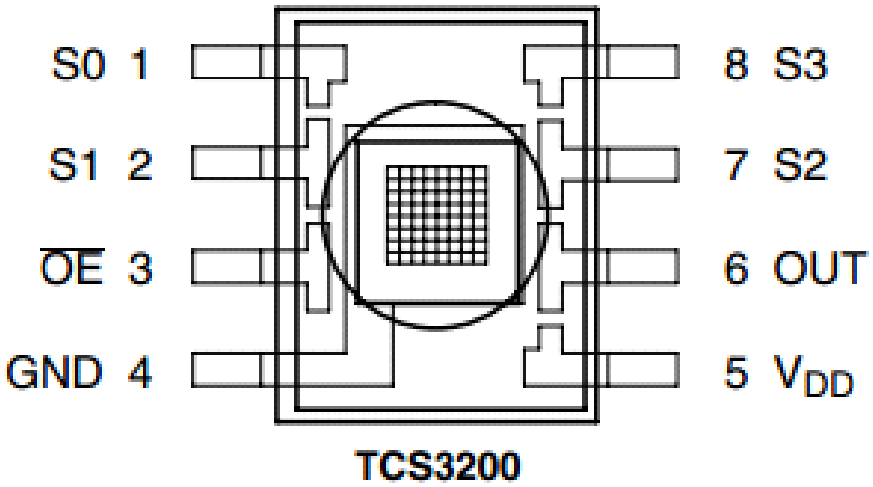

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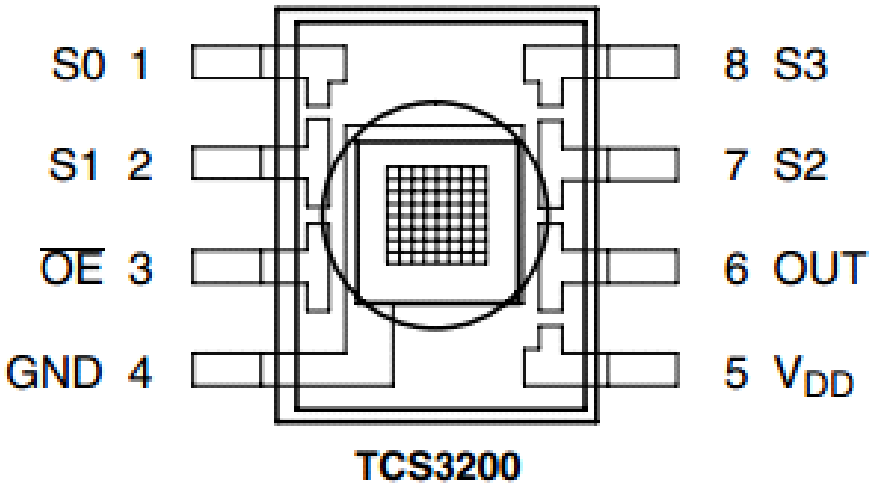

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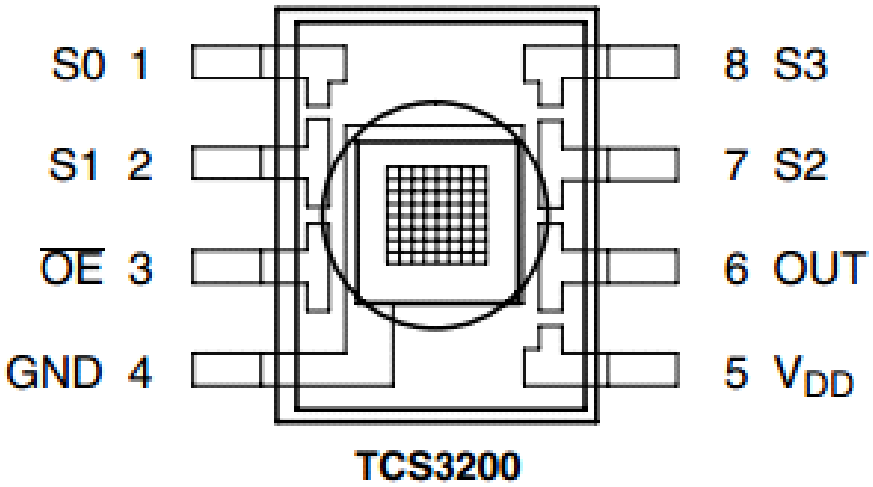

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- Pins 7 and 8 are S2 and S3. They are photodiode type selection inputs.
- Pin 4 is ground and Pin 5 is Vdd (5 Volts). Pin 3 is not connected.

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- For our application we use 20 percentage scaling i.e keeping S0 HIGH and S1 LOW. The reason for 20 percent scaling is that if the scaling is high then the readings won't fit on the LCD screen.

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- To detect a given color we need to take the readings after selecting each photodiode separately. For example: If the the given color is RED, you will get very high reading when you select RED photodiode and you will get very low reading when you choose BLUE or GREEN photodiode.

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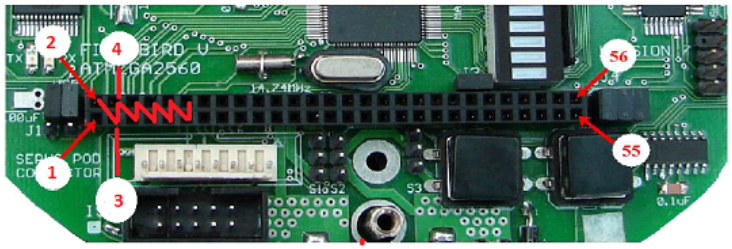

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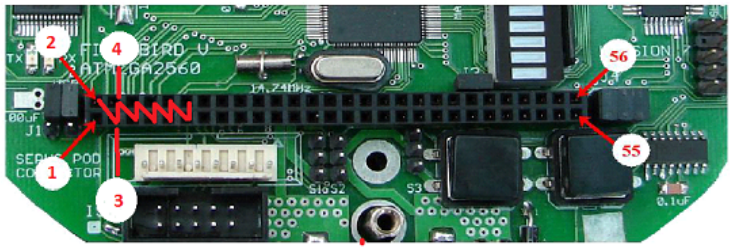

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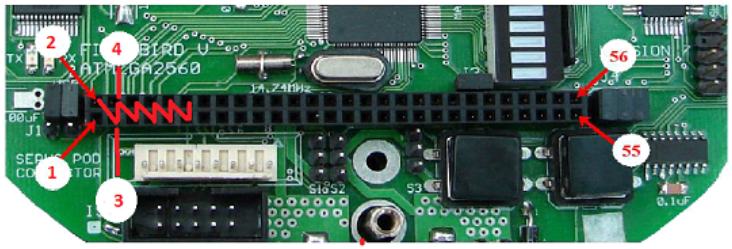

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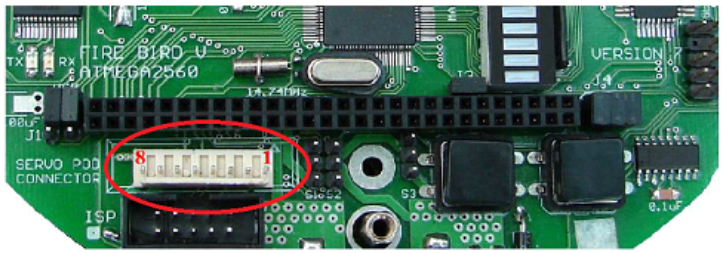

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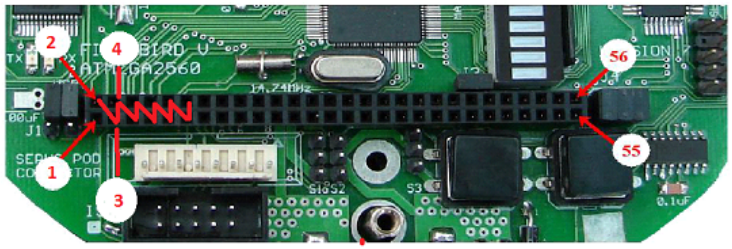

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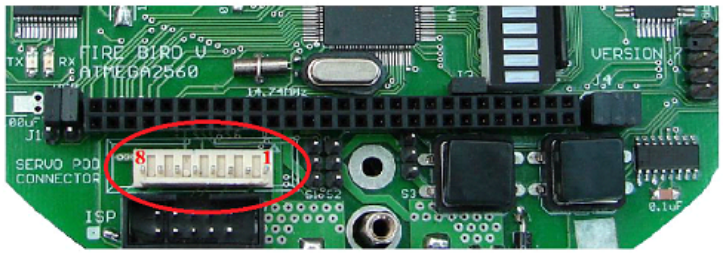

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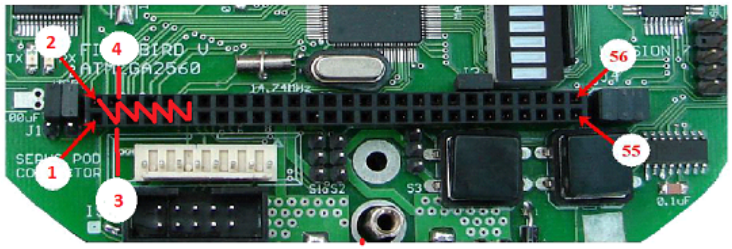

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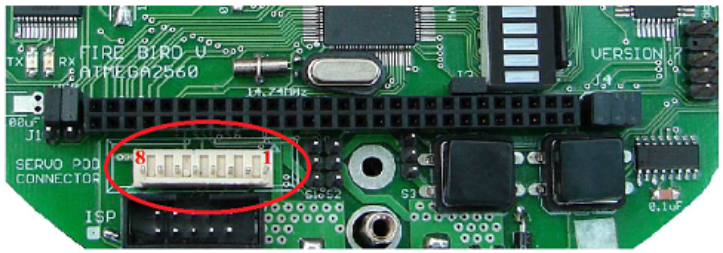

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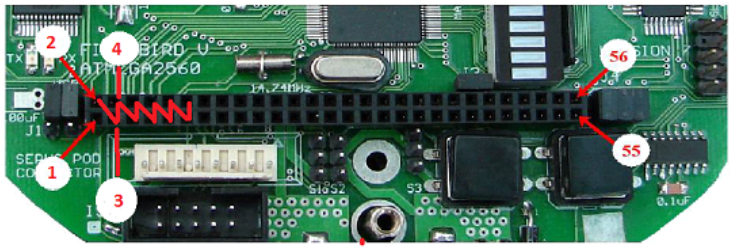

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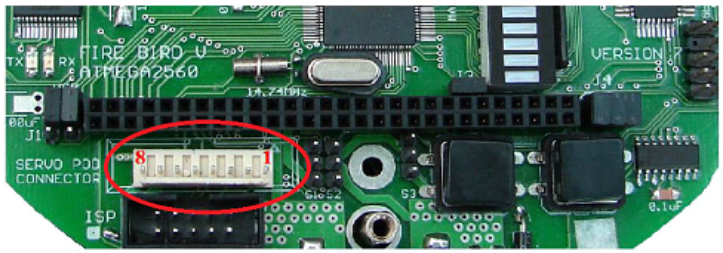

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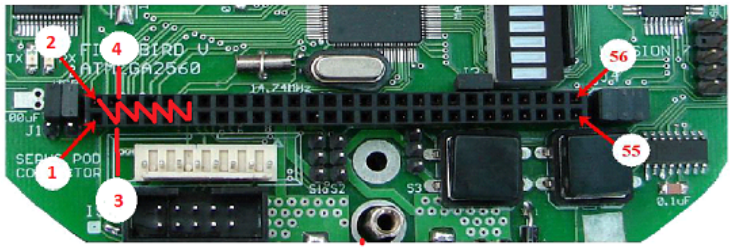

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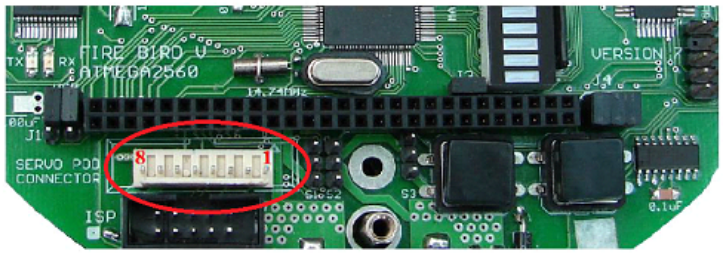

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Steps to identify the color of an object

- Hold the color sensor at a distance of around 2 cm - 4 cm from the object whose color is to be detected and then run the code.
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- Select the RED photodiode and store the number of pulses received.
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- Select the GREEN photodiode and store the number of pulses received.
- Since the color is RED, the RED photodiode may give large number of pulses for e.g around 25000 whereas BLUE photodiode may give around 10000 and GREEN photodiode may give around 12000 pulses. Thus the values received are RED (25000), BLUE (10000) and GREEN (12000).

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- You will notice that the difference between the pulses received from RED and BLUE as well as RED and GREEN photo diodes are very large.

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- Thus the the color of the object is RED because red photodiode gave more pulses than green and blue.

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- Similarly BLUE and GREEN colors can be detected.

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- Similarly BLUE and GREEN colors can be detected.
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- Similarly BLUE and GREEN colors can be detected.
- **Please go through the color sensor tutorial video to understand this section properly.**
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- Hold the color sensor at a distance of around 2 cm - 4 cm from the object whose color is black and then run the code.
- Logic of the code:

Example 2: To detect BLACK color - Special Case

- If the color to be detected is BLACK then following is the procedure.
- Hold the color sensor at a distance of around 2 cm - 4 cm from the object whose color is black and then run the code.
- Logic of the code:
  - Select the RED photodiode and store the number of pulses received.

Example 2: To detect BLACK color - Special Case

- If the color to be detected is BLACK then following is the procedure.
- Hold the color sensor at a distance of around 2 cm - 4 cm from the object whose color is black and then run the code.
- Logic of the code:
  - Select the RED photodiode and store the number of pulses received.
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Example 2: To detect BLACK color - Special Case

- If the color to be detected is BLACK then following is the procedure.
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- Logic of the code:
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- Hold the color sensor at a distance of around 2 cm - 4 cm from the object whose color is black and then run the code.
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  - Now compare the number of pulses received after using each type of photodiode with a **threshold value** (explained in the next section).

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  - Now compare the number of pulses received after using each type of photodiode with a **threshold value** (explained in the next section).
  - If all the three values (RED, BLUE and GREEN) are less than this **threshold value** then the color is BLACK.

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- Hold the sensor in front of the **BLACK paper** given in the kit.

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- For example: you received three values - Red (2500), Blue (1800), Green (2000).

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- For example: you received three values - Red (2500), Blue (1800), Green (2000).
- **Now if we compare the values directly as explained in Example 1, then you might conclude that this color is RED because RED pulses are more. But you must notice that the values received in Example 1 were very high as compared to the values in the above example.**

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- As there is no direct way to to detect the black color using the color sensor, we use the following method:
  In the above example since all the values are under 3000, we choose 3000 as the threshold value **(Even 2800 or 3200 could have been be chosen. Its upto you to fix a value which is most suitable)**.
  Once the values given by all the three photo diodes are less than the identified **threshold value** then it does not matter which photo diode gave more value.

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- In order to detect all the four colors, you first need to check for the black color. If the color is black then no need to check for other colors. But if the color is not black then you should go ahead to check it for RED, BLUE and GREEN colors.

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- Please do not proceed without studying the **Position Encoder** tutorial.

Syntax for C-Program

Port Initialization

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Color Sensor Pin Initialization

Syntax for C-Program
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Color Sensor Pin Initialization

```
void color_sensor_pin_config(void) //Configure Interrupt 0
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 DDRD  = DDRD | 0xFE; //Set the direction of the PORTD pin 0 as input
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Syntax for C-Program

Interrupt Initialization

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Color Sensor Interrupt Initialization

Syntax for C-Program
Interrupt Initialization

Color Sensor Interrupt Initialization

```
void color_sensor_pin_interrupt_init(void) //Interrupt 0 enable
{
 cli();                 //Clears the global interrupt
 EICRA = EICRA | 0x02; // INT0 is set to trigger with falling edge
 EIMSK = EIMSK | 0x01; // Enable Interrupt INT0 for color sensor
 sei();                 // Enables the global interrupt
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- For complete code please download the zip folder from your account on e-yantra portal.

Thank You!

Post your queries on: http://qa.e-yantra.org/