The Relay Module has several channels, each of them is connected to a resistor of different resistance characteristics. The shift of the channels is possible with the use of a micro program, processed by a microcontroller.


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## RGB-HSV CONVERTER IN COMPUTER VISION SYSTEMS


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Color model refers to an abstract model describing the representation of colors as tuples of numbers, usually as three or four values, called color components or color coordinates. Together with the method of interpreting this data, the set of colors of the color model defines the color space.



*Keywords*: color model, RGB, HSV, RGB-HSV converter.


**RGB color space.** RGB model is based on the reproduction of any color by adding three main colors: **r**ed, **g**reen and **b**lue. Each channel-R, G or B - has its own separate parameter indicating the amount of the corresponding component in the final color. RGB color space requires a lot of expenses, as the color depth here is high, i.e. 3 channels of 8 bits each, which gives a total of 24 bits.

Since the RGB model is the addition of colors, it is called additive. A *unit cube* is used to represent the *color space* of *RGB* model.

**HSV color space.** We can describe HSV color space with the help of a hex cone model with three dimensions. H stands for Hue, which varies between 0-360° where red falls between 0 and 60 degrees, yellow falls between 61 and 120 degrees, green falls between 121-180 degrees, cyan falls between 181-240 degrees, blue falls between 241-300 degrees, and magenta falls between 301-360 degrees. S stands for Saturation, which describes the amount of gray in a particular color, from 0 to 100 percent. The larger this parameter, the "cleaner" the color, so this parameter is sometimes called chroma. And the closer this parameter to zero, the closer the color to neutral gray. V stands for Value, which works in conjunction with saturation and describes the brightness or intensity of the color, from 0 to 100 percent. With the increase in the value, the color space becomes brighter and reveals various colors.

A color in one absolute color space can be converted into another absolute color space, and back again, in general; however, some color spaces may have gamut limitations, and converting colors that lie outside that gamut will not produce correct results. There are also likely to be rounding errors, especially if the popular range of only 256 distinct values per component (8-bit color) is used.

$$H \in [0, 360]$$
$$S, V, R, G, B \in [0, 1]$$

$MAX$ — maximum value of $R$, $G$ и $B$, а $MIN$ — minimum

$$H = \begin{cases} 0, & MAX = MIN \\ 60 \times \dfrac{G - B}{MAX - MIN} + 0, & \text{if} \quad MAX = R \text{ и } G \geq B \\ 60 \times \dfrac{G - B}{MAX - MIN} + 360, & \text{if} \quad MAX = R \text{ и } G < B \\ 60 \times \dfrac{B - R}{MAX - MIN} + 120, & \text{if} \quad MAX = G \\ 60 \times \dfrac{R - G}{MAX - MIN} + 240, & \text{if} \quad MAX = B \end{cases}$$

$$S = \begin{cases} 0, & \text{if} \quad MAX = 0; \\ 1 - \dfrac{MIN}{MAX}, & \text{else} \end{cases}$$

$$V = MAX$$


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## FREQUENCIES OF COLORING PHENOTYPES OF SYNANTHROPIC URBAN PIGEON *(COLUMBA LIVIA* F.*URBANA)* IN REGIONAL CITIES OF BELARUS

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Coloring of urban pigeon in large cities of Belarus was explored on the example of all its regional centers. Variability of coloring polymorphism was identified, which depends not only on the impact of urban load, but also on contact with domestic pigeons.

*Keywords*: coloring polymorphism, color morph, synanthropic urban pigeon, domestic pigeon.

Currently much attention is paid to the study of synanthropization of animals, especially how does it change and what does coloring pigeons in different settlements depends on. The study of the color of pigeons has been carried out in the cities of the world for more than fifty years. Coloring polymorphism has been studied in New York, Paris, London, Warsaw, Gdansk, Gdynia, Lodz, Krakow, Berlin, Venice, Vienna, Moscow, Leningrad, etc. According to most researchers, coloring polymorphism is associated with population density of pigeons, features of its nutrition, pollution of urban landscapes, geographic location, and even with historical events in the life of a country [1]. Synanthropic urban pigeons which settled around the globe are extremely valuable objects for population genetics.

In recent years, active research in this direction has been conducted in the capital of Belarus - the city of Minsk [2–5]. Such studies were not conducted in the regional centers of the Republic of Belarus. In this regard, we had a goal – to conduct a comparative analysis of the coloring polymorphism of the synanthropic urban pigeons in the regional administrative centers of Belarus – Brest, Vitebsk, Gomel, Grodno, Minsk and Mogilev.

Color morphs were studied in Minsk in 2015-2019, in regional cities – in July-September 2019. Coloring polymorphism of pigeons was determined by the method of Yu.A. Dunaeva. (2018), according to which urban pigeons were divided into four groups: group one – "wild type" (bluish), group two – “hammered” (with black specks of different sizes), group three – "melanists" (black) and the fourth group is “aberrants” or “deviators” [1]. In the last group, we included all the birds that did not fit into any of the first three types.

Analysis of the material showed that in all cities of Belarus the dominant coloration of synanthropic urban pigeons is a group of hammered pigeons, the indicator of which ranges from 75,8±4,3 % (Gomel) to 53,7±3,9 % (Mogilev). An intermediate position in this color morph are occupied by Vitebsk, Minsk, Brest and Grodno – 65,7±3,7, 62,1±5,8, 58,9±4,7 and 59,7±4,5 %, respectively.

The second place is occupied by the bluish morph, the percentage of which ranges from 13,4±2,3 (Gomel) to 34,6±3,5 (Mogilev). An intermediate position in the color of wild-type plumage (bluish) is found in all the same regional centers - Vitebsk, Minsk, Brest and Grodno – 27,0±2,1, 22,3±3,7, 19,0±1,9, 24,5±2,2 %, respectively.

Pigeons of black color are most often found in Minsk and Brest, where they account for 7.3±0.5 and 4.4±0,4 %, respectively. In Gomel, Grodno, Mogilev and Vitebsk the percentage of occurrence of melanists is much lower – 2,7±0,8, 2,3±0,2, 2,1±0,2 and 1,1±0,1 %, respectively.

The occurrence of brown, piebald, lilac, chestnut (deviators) is very high in the western regions of the republic – Brest (17,4±2,4 %) and Grodno (13,5±1,8 %). This indicator is slightly lower in Mogilev (9,6±1,5), approximately the same in Minsk (8,3±1,2 %) and Gomel (8,1±1,2) and the lowest in Vitebsk (6,4±0,8).

Thus, in the coloring polymorphism of the synanthropic urban pigeon of large cities of the Republic of Belarus the hammered color morph occupies a dominant position – 57,65±3,5 %. The percentage of wild-type pigeons (bluish) is significantly lower – 23,46±2,6 %. The frequency of occurrence of melanists is the lowest – 3,36±0,3. As for deviators, its share as a whole in the republic is rather high – 10,55±1,7 %. And there is a reason to presume that the increase in the number of aberrants in a city directly depends on the number of dovecote, what is eloquently shown by statistics on the city of Brest.

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