Problem:

In order to have the desired hair color or even restore the color of the original hair roots that re-appear after a while, a person needs to visit a hair salon and spend time and money to achieve the desired hair color. However, this constant visit to beauty centers, for example, to re-color one or two centimeters of the hair roots, is not always desirable for a person. In fact, it is time for a revolution in this field to bring convenience and cost reduction to people.

Solution:

ColorFluent is a game-changer in this field. It is a smart color comb that enables the user to color their roots or their entire hair using a few simple instructions, all by themselves, yes, without having to go to the salon.

Smart comb design:

Talking about a tool that is the size of a hair iron straightener and can color hair without the help of another person is a very attractive idea. But in practice, implementing the required mechanisms in such a small space is a very difficult task. But we were looking to create a revolution in this field and welcomed the challenges ahead.

General description of the function of the color comb:

While this comb has relatively complex components, it is easy to use. In this way, the person first enters the guide section for preparing hair dye using its dedicated application and receives the instructions for preparing the dye. Then, he pours the dye into the comb and prepares the device by making a series of settings such as the speed of the material exiting the nozzle, warnings, etc. Like a hair iron straightener, the user places a section of his hair between the jaws of the device and presses it, while simultaneously moving the comb downwards to distribute the dye appropriately on the hair.

Introduction to the internal components of the paint comb:

In general, the overall block diagram of the device is as follows:

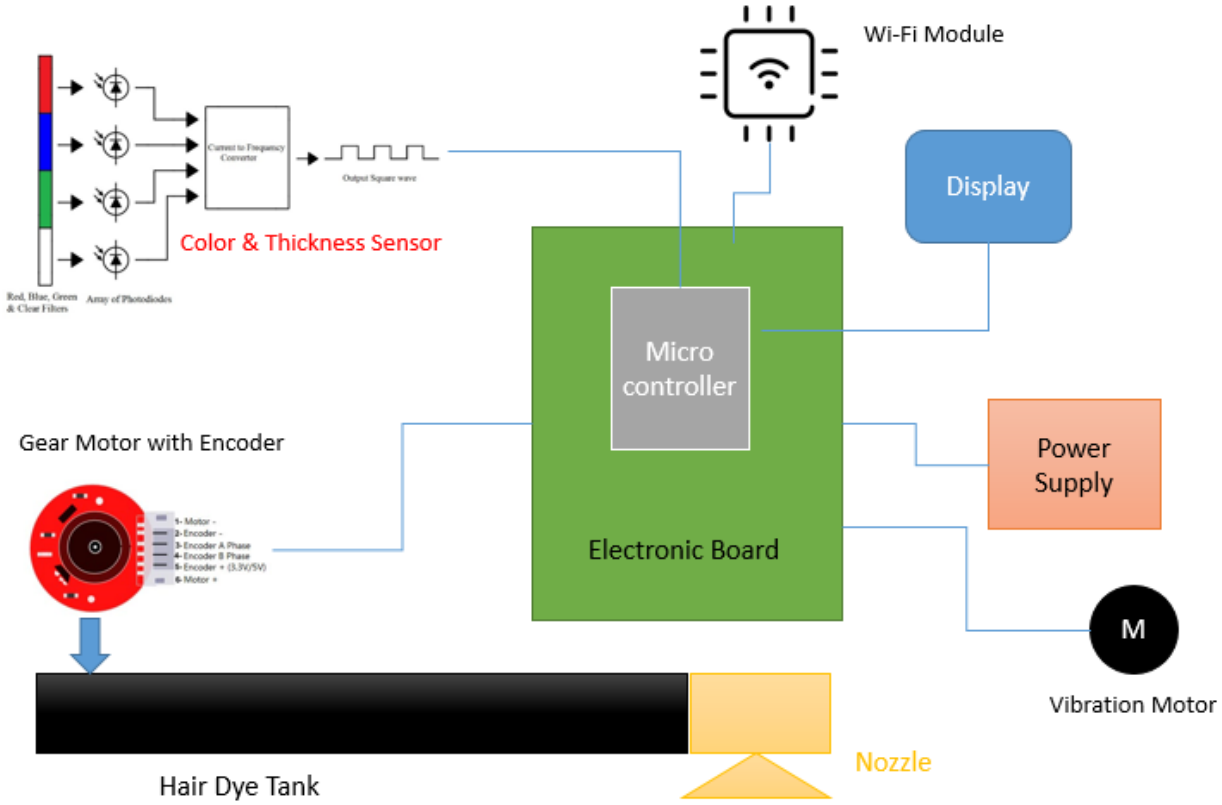


Figure 1: Color comb block diagram

Introduction to the different parts of the device:

1: Electronic board:

The electronic board includes components such as a microcontroller, motor driver, capacitors, resistors, and other components that this product needs to work.

2: Hair color and thickness detection sensor:

This sensor consists of two parts: color detection and thickness detection. In the color detection part, using a series of diode arrays sensitive to the main red, green and blue (RGB) lights, it measures the hair color and the border between the dyed parts and the hair root, which has a natural color. This information is sent to the electronic board in the form of a pulse with a specific frequency. Also, in the thickness detection part, using a special microchip located in this sensor, the thickness of the hair is measured and its information is sent.

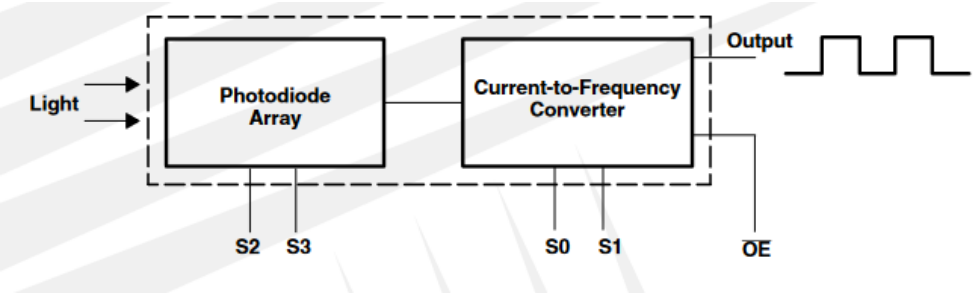


Figure 2: Color sensor block diagram

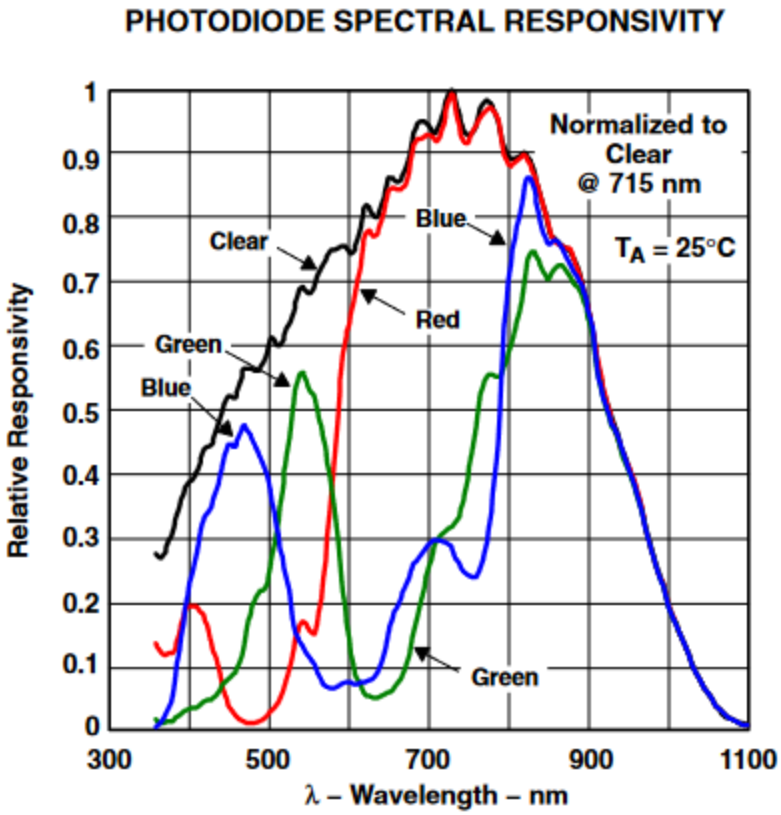


Figure 3: Sensor sensitivity chart to primary colors (RGB)

The microcontroller on the board processes this data and converts it into understandable information. This information is processed in subsequent stages and commands are issued based on it, for example, to control motors.

3: Vibration motor:

The function of this motor is to create localized vibration in the area where the nozzle is located, which helps to better distribute the color on the hair.

4: Power adapter:

Due to the weight reduction of the device, the power supply is placed outside the device, which powers the electronic board and sensors via a wire and a connector.

5: Display:

This device is equipped with an OLED display through which the user can configure the device. These settings include motor speed, alarm settings, tank filling settings, color range settings, etc.

6: Hair dye tank and nozzle:

This product has a tank for filling the materials needed for hair dyeing and also a special nozzle for the material to come out. This tank and nozzle are made of aluminum for being light and having high resistance. The tank has a cap as well as a funnel for pouring the dye material inside it.

7: Gearbox motor:

A special mechanism must be used to move the paint material inside the tank. In fact, the tank assembly is like a tube with a piston inside it and with the help of an electric motor at the beginning, a driving force is installed to push the material out of the nozzle. It should be noted that the motor power has been increased by a miniature gearbox. There is also an encoder on this motor that can count the number of revolutions of the motor, which, using mathematical formulas, is

converted into information that can be used to determine the level of filling of the paint tank.

8: Wi-Fi module:

In addition to being able to make settings and operating modes of the device through the buttons on the body, this device can make settings through an application with the help of a Wi-Fi module located inside it.

9: Device body:

The device body is made up of several parts such as the main body, the lower body, the tank cover, the tank holder, and several other parts.

3D view of the device:

Figure 4: 3D view

View of the built device:

Figure 5: Sample image created

Application:

Nowadays, using apps alongside gadgets and electronic devices that we all use is inevitable. Using apps makes working with devices easier for us and provides us with more features.

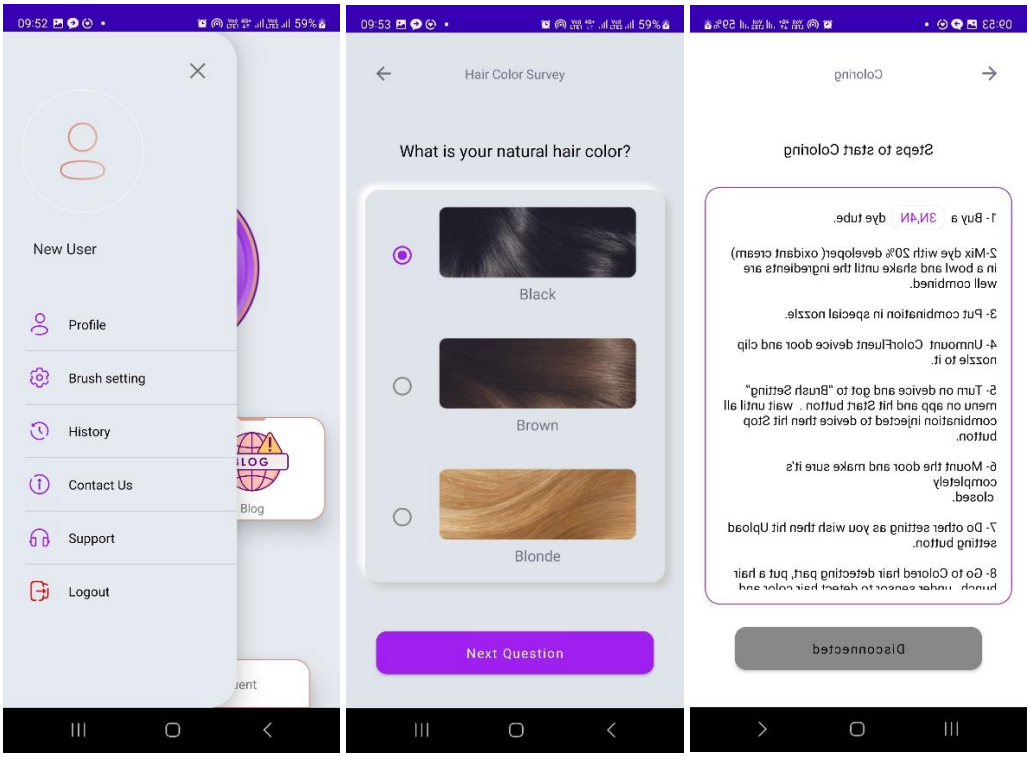
For this purpose, we designed a dedicated app to communicate with the colorfluent smart color comb, which, in addition to being able to adjust the comb parameters such as motor speed, color range settings, etc., also provides users with other features.

For example, in the Survey section, users will be able to follow a multi-step process to receive the right hair color combination and instructions for using it. In addition, all instructions are saved in this app itself so that the user can refer to it in future series.

This app also has a timer that the user can use as a reminder (hair color time) by setting different time intervals.

This app also has another section where the user can access the latest articles or news related to skin and hair health and beauty. Also, in future updates to the app, the ability to see stores that supply hair dye cosmetics will be added so that users can easily visit the nearest stores that supply these materials and purchase their desired product.

The following are images of the app environment.



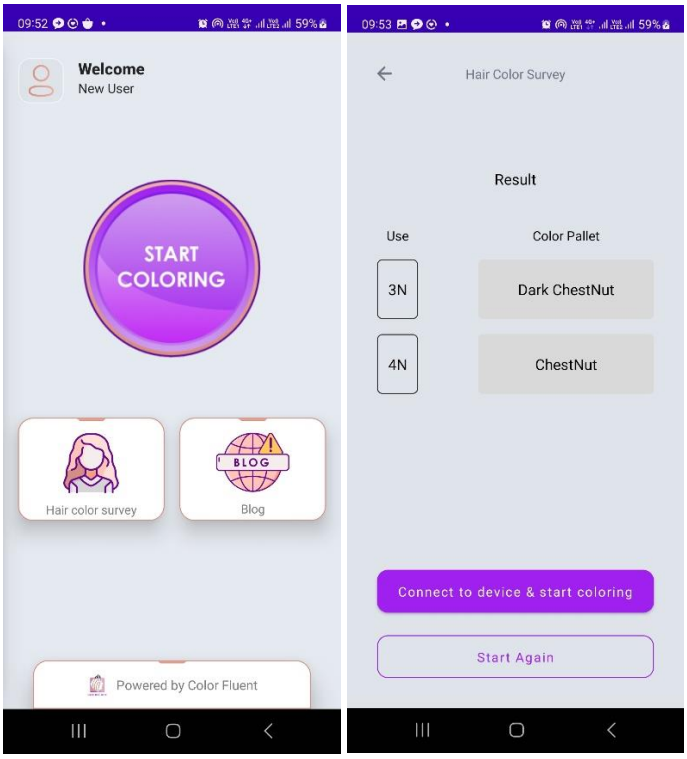


Figure 6: Collection of images from some app pages