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Design of Smart Oral healthcare Device

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ABSTRACT: A toothbrush is a dental instrument used for cleaning teeth. It is ideally used with toothpaste or mouthwash. A toothbrush has been an integral part of a daily routine across many cultures around the world. The main objective of this paper is to build a toothbrush that reduces the problem related to our teeth and user can see the level of germs through his/her mobile device. This product would be eco-friendly and can use by any age group of people.

Keywords — UV-rays, Camera, Toothbrush, Dental, Dentist, Oral Healthcare

I. INTRODUCTION

Tooth cleaning is an essential part of every human being. Oral hygiene practices are used to remove dental plaque and debris using a toothbrush without injuring the soft tissue. Out of all oral hygiene aids, Toothbrushes are the most commonly used.

An individual should spend at least 2 minutes brushing their teeth with an effective technique at least twice a day, according to oral health care professionals. However, studies show that actual brushing time varies between 30 tor 60 seconds.

Brushing your teeth incorrectly can have a negative effect. It depends on how much force with which a person uses the brush and the type of bristles. Brushing too hard can damage your gums and can cause them to recede. The harder the bristles, the greater the risk of harming your gums.

As per scientific studies, people who use an electric toothbrush have less tooth decay, healthier gums compared with those who use a manual toothbrush.

The manufacturing process for plastic toothbrushes gives harmful plastic by-products along with petroleum and crude oil. Disposal of the brushes is also an issue.

II. LUMIO HARDWARE

The LumiO hardware comprises a camera, toothbrush head, electric toothbrush body, and a microcomputer. LumiO system uses a variant of this PPI to quantify plaque on teeth.

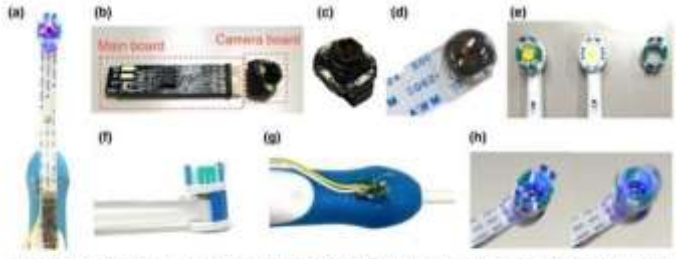

Figure 3: The LumiO hardware construction. (a) The LumiO device. (b) The camera used in the LumiO hardware. This component consists of the camera head and main board. (c) We modify the camera by attaching an optical high-pass filter to its lens and replace the lighting components with blue-violet LEDs. (d) We solder the camera directly onto FFCs and waterproof it with resin. (e) (From left to right) An intact Oral-B ProWhite brush head, a head with its hair removed, and only the brush part. (f) The toothbrush head with the camera board placed between two modified ProWhite brush head (viewed from the side). (g) The back of our modified Oral-B electric toothbrush. We solder wires on electrodes to control the power switch. (h) A zoomed view of the camera part. The camera is completely isolated from the brush, and stays still even when it is activated.

Fig.1. Image of current LumiO hardware prototype.

III. LIST OF COMPONENTS USED

- Camera
- Ultra violet led bulbs
- Cam and gears
- Switch On/Off buttons
- Circuit board
- Rechargeable battery
- Display

A. Intraoral Camera

QLF mode captures the area of plaque although it is not a high-end sensor. An intraoral camera is the

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main sensor in LumiO, and has to satisfy the following requirements:-

- Small enough to be integrated into a toothbrush head,
- Short focal length, and
- Low-cost for production

The camera device used in the current LumiO prototype is GDT MZ-USB001 Endoscope. The camera consists of two boards: the main and camera parts. The main board has integrated circuits to convert the signals from the camera, and it connects to an external computer through USB. The camera board has a CMOS sensor covered. [1]

Camera Component Details:-
Resolution: - 640x480 Color depth: - 24 bits
Focal length: - 2 – 10 cm (best at 6 cm)
Angle of view: - 60°
Frame rate: - 10 fps
Operating voltage: - 5V
Power: - 120 mA / 30µW

B. **UV LEDS**

UV-A, UV-B, and UV-C are the three ranges of UV light. UV-Ahas a wavelength in the range of from 315 nm to 400 nm and also is known as near-UV or black light. UV-B has a wavelength in the range of 280 nm to 315 nm and is also known as medium wave light. UV-C has a wavelength in the range of 200 nm to 280 nm and is also known as short wave UV light [5].

Ultraviolet (UV) LEDs have applications in the field of optical data storage, water treatment, polymer curing, biological agent detection, and communications. The UVC region has a wavelength between 100 nm to 280 nm [6]. The optimum wavelength is in the region of 260 nm to 270 nm for disinfection. Germicidal efficacy falls exponentially with longer wavelengths. UVC LEDs can be switched on/off instantaneously and without cycling limitation, offer no hazardous material, are more durable, and have lower heat consumption [6].

A Germicidal UV-C light is used for the product. Germicidal UV-C light is commonly used to inactivate or kill microbes on surfaces, in air, and in water. When implemented properly, UV-C lighting can kill up to 99.9% of pathogens.

Fig.2. Image of UV LED and camera

IV. WORKING

Fig.3. Image of basic working flowchart

In this product, Raw bamboo material is used for the body of the brush. The head part is made up of rubber and abs plastic material so that it will be slightly flexible. In the lower part the display is inserted and the battery, as well as the control unit, controls every part. A LED and camera are connected in the tooth head which is connected through a rechargeable battery and from there supply is going and the timer starts working and there is also a UV light in the head of the brush by which all the bacteria is going to kill by UV rays.
The circuit is displayed below and the toothbrush is connected to mobile through Bluetooth, where we can either use Wi-Fi.

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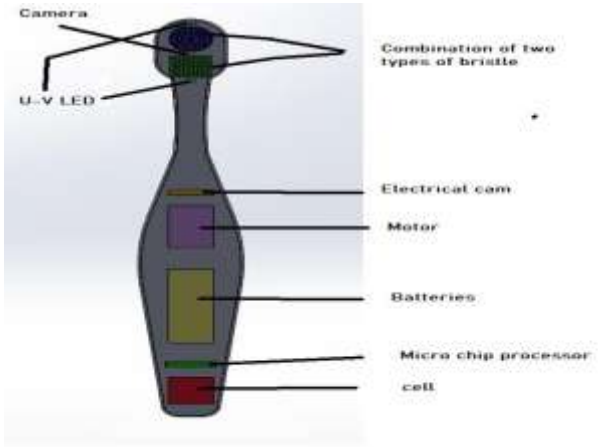

Fig.3. Image of typical arrangement of an electrical toothbrush

Fig.2. Image showing brushing time

V. OTHER FEATURES

A. Timer

Many modern electric toothbrushes have a timer that buzzes after two minutes, and sometimes every 30 seconds.

B. Display

LCD screens are used to show brushing time and sometimes smiley in some electric toothbrushes. Smileys or other images could encourage people to brush more accurately.

C. Pressure Sensor

Enamel and gums get damaged when brushed too hard. Hence most modern top-end sonic toothbrushes come with a pressure sensor to prevent users from brushing too aggressively.

D. Ultrasound Indicator

Ultrasonic frequencies are not audible and the amplitude of movement is typically too small to be interpreted. Hence Ultrasonic toothbrushes notify the user that ultrasound is being emitted using ultrasound indicator.

E. Bluetooth

Transferring of data from an electric toothbrush to another device, such as a smartphone is carried out using Bluetooth connectivity. It sends data such as the duration of brushing and how much pressure is applied etc.

F. Size of Brush and Bristles

The best sizes are used to design the toothbrush depending upon the user context. There are many bristle patterns such as block, Wavy or V-shaped, Multilevel trim pattern, Criss-cross pattern, Polishing bristles etc.

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Fig.4. Image showing dimensions of the right toothbrush

Fig.5. Rendered image of my toothbrush


Fig.6. Rendered isometric view of my toothbrush

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Fig.7. Rendered isometric view of my toothbrush

Fig.8. Rendered isometric view of my toothbrush

VI. CONCLUSIONS

The main focus of my product is to clean our teeth in an effective manner. The main part of my product has a LED, Camera, and Timer to brush our teeth with a real-time view. The product is fully sustainable. It also has UV lights to kill germs. We can set a timer for cleaning our teeth. And the bristle of the brush is very soft so that it cannot damage your gums. It has a removable bristle part so that if the bristle part is damaged, we can easily remove the damaged bristle and add the new one.

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