Ultraviolet radiation quantification device for the prevention of Skin Cancer "Alert Skin"

Dispositivo cuantificador de radiación ultravioleta para la prevención de Cáncer de Piel "Alert Skin"

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Abstract

The objective of this article is the diffusion of technological innovation of the Ultraviolet Radiation Quantifier Device for the prevention of Skin Cancer. The method used in the investigation was: Quantitative, longitudinal, prospective, experimental. The viability of Design of a Ultraviolet Radiation Quantifier device was determined, the Ultraviolet Radiation Quantifier Device was made, the device was programmed to emit a signal to a mobile device, a platform compatible with the Android operating system was designed. Figure 1 The results obtained were: Ultraviolet Radiation sensor, Arduino and Bluetooh module were made, an application for mobile telephony was created called: Alert Skin for the prevention of harmful effects of Ultraviolet Radiation (Skin Cancer), with a total cost of 1332.00 pesos. Figure 2 Conclusions: Information and Communication Technologies can be used for preventive actions in Health, in this case, prevention of the harmful effects of Ultraviolet Radiation, such as Skin Cancer. Figure 3

Prevention, Cancer, Skin, Ultraviolet Radiation

Abstract

El objetivo del presente artículo es la difusión de innovación tecnológica del Dispositivo Cuantificador de la Radiación Ultravioleta para prevención de Cáncer de Piel. El método utilizado en la investigación fue: Cuantitativa, longitudinal, prospectiva, experimental. Se determinó la viabilidad de Diseño de un dispositivo Cuantificador de Radiación Ultravioleta, se realizó el Dispositivo Cuantificador de Radiación Ultravioleta, se programó el dispositivo para que emita una señal a un dispositivo móvil, se diseñó una plataforma compatible con sistema operativo Android. Figure 1-2. Los resultados obtenidos fueron: Se realizó un sensor de Radiación Ultravioleta, arduino y módulo Bluetooh, se creó una aplicación para telétono móvil llamada: Alert Skin para prevención de efectos nocivos de la Radiación Ultravioleta (Cáncer de Piel), con un costo total de 1332.00 pesos. Figure 2. Conclusiones: Se pueden utilizar tecnologías de la Información y de la Comunicación para acciones preventivas en Salud, en este caso, prevención de los efectos nocivos de la Radicación Ultravioleta, como Cáncer de Piel Figure 3.

Prevención, Cáncer, Piel, Radiación Ultravioleta

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Introduction

Chronic exposure to sunlight - especially the UVB component - accelerates skin aging and increases the risk of skin cancer. The environmental irradiation of said agent, hence the risk factor for photo-oxidative damage is increased, with long-term negative effects for aging, consequent decrease in the quality of life of patients and early appearance of skin cancer due to damage irreparable in DNA induced by ultraviolet light.

Reflection does not only occur at the surface of the stratum corneum, therefore at all interfaces a refractive index may occur. Dispersion occurs due to all the structural elements found in the skin, such as hair follicles, sebaceous glands and cellular components, as well as mitochondria and ribosomes. The remnant of UV light can, therefore, penetrate into the deeper layers of the skin. The penetration of UV light within the dermis exposes a variety of cells and structures, which depends in part on the thickness of the stratum corneum of the epidermis. The depth of penetration depends on the size of the wavelength. The same incident exposure of UVA and UVB radiation resulting from a high exposure can penetrate deeply.

The same incident exposure of UVA or UVB radiation resulting from a high exposure can penetrate deeply. The melanin particles are distributed in the stratum corneum depending on the type of skin, therefore six skin phototypes are considered according to the Fitzpatrick classification: Type I: Frequent and very easy sunburn. Pigmentation null or almost nil. Type II: Frequent and easy sunburn. Discrete pigmentation sometimes. Type III: Sunburn present. Light pigmentation. Type IV: Very rare or absent sunburn. Constant or intense pigmentation. Type V: Moderately pigmented skin. Type VI: Black skin.

The ability of the human skin to regenerate decreases with the passage of time and with exposure to UV light, therefore there is an increase in the fragility of it, with a reduction of skin cells and connective tissue collagen.

The damage induced to DNA by UVB radiation is the main factor that allows the induction of mutations and the beginning of the carcinogenic process.

Extrinsic cutaneous aging begins around 35 years of age, the sun is responsible for 90% of aesthetic lesions, attributed without any reason to physiological aging. Cutaneous aging is a complex biological phenomenon that affects the different components of the skin. There are intrinsic and extrinsic effects in the aging process.

In the skin there are changes at the level of the epidermis as melanocyte decline in approximately 15% per decade, doubling its density in photoexposed areas, there is also a decrease in Langerhans cells, decreasing sensitivity and immunity. In the dermis there is decreased collagen (1% per year) and decrease of fibroblasts with a progressive decrease of elastic tissue in the papillary dermis. Exposure to ultraviolet radiation initially produces an infiltration of neutrophils in the dermis, this infiltration is the key that activates the release of enzymes such as elastase and matrix metalloproteinase. There is also a reduction in the capacity of DNA regeneration. In addition, there is a reduction in the cutaneous microvasculature; Ultraviolet radiation, infrared rays and heat induce angiogenesis.

The clinical effects on the skin produced by ultraviolet radiation in chronic form are called photo-aging, ie the damage produced by the sun accelerating the aging of the skin. Table 1. This phenomenon is independent of the real aging of the skin, therefore it can be avoidable, and, therefore, in this investigation is considered knowledge about prevention using the range of frequency of use of sun protection measures in the last week. , as follows: (1 = never, 2 = rarely, 3 = less than half the time, 4 = more than half the time, 5 = almost all the time and 6 = always).

Hurt	Description	features
Type I (Medium)	Without wrinkles	Early photoaging Primary pigmentary changes media Minimal wrinkles Age of the patient between 20 and 30 years Minimal scarred acne
Type II (Moderate)	Wrinkles in movement	Early to moderate aging Senile lentigines visibly Keratosis palpable, not visible Lines parallel to the smile Age of the patient between 30 and 40 years Average acne scars

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Type III (Advanced)	Wrinkles at rest	Advanced photoaging Discromía, telangiectasias Age of the patient 50 years or older Acne scars
Type IV (Severe)	Only wrinkles	Severe photoaging Malignant lesions No areas of normal skin Age of the patient between 60 and 70 years Severe acne scars

Table 1 Classification of Photoaging. Correlation between solar exposure practices and the degree of photodamage

It must be borne in mind that sometimes photoaging is accompanied by another effect of UVR which is photocarcinogenesis or the appearance of premalignant lesions: actinic keratosis, cutaneous horn, actinic cheilitis, Bowen's disease; or malignant lesions: basal cell carcinoma, squamous cell carcinoma, malignant melanoma on the skin.

In particular, it is important to consider that UV radiation is capable of being strongly absorbed by the conjugated double bonds of pyridines and pyridimines, causing the biomolecules to become reactive or ionizing them, to the extent that it can cause burns to the human skin or cause cancer. See "table 2".

Light type	Wavelength	Carcinogenicity
UVC	200-290	+++
UVB	290-320	++
UBA	320-400	+

Table 2 Characteristics of Ultraviolet Radiation and its relationship with Carcinogenicity. -: weak or no effect, +: slight effect; ++: moderate effect; +++: severe effect

UV solar radiation occurs with greater intensity in our latitudes during spring, summer and autumn between 11:00 and 15:00 hours, being particularly high in summer, although it decreases its intensity on cloudy days, while on the other hand the inclination with which the sunlight arrives during the winter months reduces its effects.

Considering that at higher altitudes on the coastline, the atmosphere is thinner, the WHO reports that for each 1000 m an increase in UV intensity between ten and twelve percent must be considered, so that at a height that oscillates about 2,300 meters as is the observed Valles Altos de Hidalgo, the intensity will reach between 23 and 27% higher compared to sea level.

The Polytechnic University of Pachuca is located in the High Valleys of Hidalgo at an altitude of 2330 meters above sea level, its climate is temperate dry, which causes scarce vegetation, which is why the solar radiation is intense due to its tropical latitude and height, is magnified by the reflection of bare floors and the materials walls and sidewalks. A research group is currently being set up with the objective of detecting and quantifying the possible dermatological damages that may occur in students and staff of the Institution. As a first stage of these investigations, the monthly quantification of ultraviolet radiation from 2011 to date is reported in this work.

Within the Mexican Republic, there is a history of similar studies, such as those carried out by the Department of Dermatology in the state of San Luis Potosí in 2003 [18], where the doses of ultra-violet radiation were reported in Mexican schoolchildren.

Exposure category	IUV interval
Low	<2
Moderate	3 a 5
High	6 a 7
Very high	8 a 10
Extremely High	11+

Table 3 Ultraviolet Radiation Indices

Ultraviolet Radiation Index	Protection Required
1-2	Does not need protection
3-7	You need protection, stay in the shade during the central hours of the day, use a sunscreen and cream and a hat.
8 or more	Avoid leaving during the central hours of the day. It is essential sunscreen, hat and stay in the shade.

Table 4 Recommendations for exposure to Ultraviolet Radiation

According to the monitoring carried out during the years 2011 to 2017, it was observed that the months in which the radiation indexes are above 8 which is considered high, up to 11 considered extremely high, occur between the months of March to October, while that during the months of November, the radiation does not show conditions that are considered potentially harmful to the skin of people.

It is important to point out that, in some years, as happened in 2011, during the months of July and August, they reached values above 14, which indicates extreme situations. The results show the intensities of ultraviolet radiation observed in the Altos de Hidalgo Valleys, particularly at the Polytechnic University of Pachuca, which is located within the municipality of Zempoala, Hidalgo. The fact that during the months of March to October exceeds values of 9 of the IUV during 207.7 days, being the value of 9 the one that is most frequently reached with 94.2 days, stands out.

It should be noted that the months of May, are those that have a greater number of days with radiation above 9, probably because there are no major cloudy in this month and the transit practically zenith of the sun to the line of the tropic of cancer (23 ° 27 '). While the month of June even though it has three days less under the IUV line, its intensity is usually the highest of the year and coincides with the solar approach and arrival at its zenith in the tropical line.

Frequently, the consequences of the effects of UV radiation are usually confused as derivatives of the atmospheric affectation of the ozone layer as occurs in the regions of the extreme south of the planet, however, what is observed in the present work, are local derived phenomena of latitude and height. It should be mentioned that despite the proximity of Mexico City with its serious pollution problems, it does not show the intensity reported here due to the protection generated by the frequent fogs during the summers.

On the other hand, it should be noted that the population of the Valleys Altos de Hidalgo should be subject to due precautions to avoid both burns and possible cases of cancer. Therefore, we consider it important that monitoring, as well as the dissemination of daily readings, be disclosed as a preventive process.

Skin cancer is one of the most common neoplasms, its incidence has increased in recent decades. The risk of a subject to develop skin cancer depends on constitutional and environmental factors. Constitutional factors include family history, light or red hair, multiple melanocytic nevi, sensitivity to sun exposure, among others. While ultraviolet (UV) radiation is a well-established environmental risk factor, and the most important.

Skin cancer doubles its incidence every 10 years. In Mexico there are about a thousand annual cases of skin cancer and because it is the largest organ of our body, the skin is susceptible to diseases caused by solar radiation.

The use of Information and Communication Technologies for the field of health in the prevention of deadly diseases such as skin cancer, which is the second most common type of cancer in Mexico.

Portable telephones suggested during the 80s of the 20th century, its diffusion is practically universal. Unlike the telephone cable used by landlines, mobile phones (or cell phones) use radio waves that provide the different mobile phone towers.

These mobile phones have auxiliary functions that depend on each model such as listening to music, radio, camera, etc.

The screens of mobile phones have a set of icons representing the most common utilities such as: contact list, calculator, etc.

Smartphones are mobile phones with more functions, the user can add different functionalities in the form of applications or programs. These applications because of their small size are often called "apps". 84% of Mexicans have a mobile device, 49% women and 51% men, in a percentage of 25% in the age range between 25 and 35 years. 78% use cellular and 39% Smartphone, with an average of possession of 2.

44% of Mexicans do not leave home without the cell phone, 60% never turn off the cell phone.

Users perceive an average of 4 advantages for the use of mobile devices, 77% of users have downloaded applications.

Methodology

Type of Research: Quantitative, longitudinal, prospective, experimental. The viability of Design of a Ultraviolet Radiation Quantifier device was determined, the Ultraviolet Radiation Quantifier Device was made, the device was programmed to emit a signal to a mobile device, a platform compatible with the Android operating system was designed.

Results

An Ultraviolet Radiation sensor, Arduino and Bluetooh module was created, an application for mobile phone was created called: Alert Skin for the prevention of harmful effects of Ultraviolet Radiation (Skin Cancer), taking into account the photoprotection recommendations by skin type, height with respect to sea level (percentage), with a total cost of 1332.00 pesos. Figure 1 to 3.

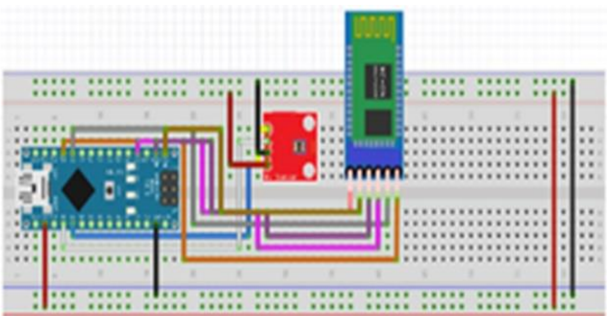

Figure 1 Design of the circuit board of the Ultraviolet Radiation Quantifier Device "Alert Skin"

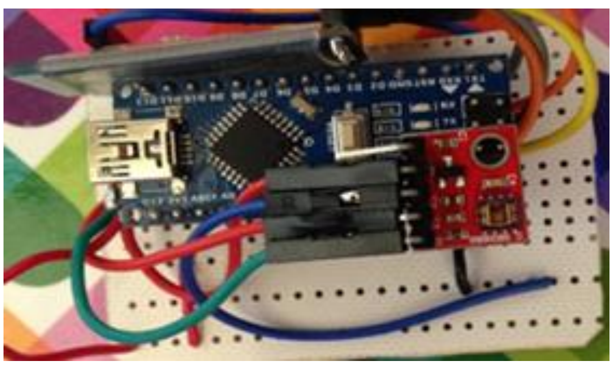

Figure 2 Installation of the circuit of the Ultraviolet Radiation Quantifier Device "Alert Skin"

Figure 3 Application "Alert Skin"

Conclusions

You can use information and communication technologies for preventive actions in health, in this case, prevention of the harmful effects of ultraviolet radiation, such as skin cancer.

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