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Design of Embedded System for Skin Pigments Disorder Identification

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ABSTRACT
This paper describes an image analysis technique that objectively study the skin pigments disorders which can be useful in assessment of treatment. The word Pigmentation means coloring. Skin pigmentation disorders affect the color of the skin. Therapeutic response of treatment results in repigmentation of the skin. However the repigmentation process is very slow and is only observable after a few months of treatment. Currently, there is no objective method in assessing the therapeutic response of skin pigment disorder treatment. The use of digital image features may help in an objective follow-up study of skin pigment disorder progression and test the efficacy of therapeutic procedures. The proposed methodology provides superior performance of skin disorder identification.

Keywords
Skin pigments, repigmentation, Embeddeed systems

1. INTRODUCTION
Skin is the largest organ of the body. It is made up of two layers, the upper 'epidermis' and the lower 'dermis'. The epidermis and the dermis are further divided into other layers. The lower most layer of the epidermis is known as the basal layer and it contains organelles called 'melanosomes'. These melanosomes contain cells caled melanocytes which produce a pigment called 'melanin'. The color of skin depends maily on this melanin and the amount of melanin present in the other layers of epidermis. These thickness of epidermis and vascularity of the epidermis are other factors affecting the color of skin.

The word Pigmentation means coloring. Skin pigmentation disorders affect the color of the skin. Skin cells give our skin color by making a substance called melanin. When these cells become damaged or unhealthy, it affects melanin production. Some pigmentation disorders affect just patches of skin. Others affect entire body. If our body makes too much melanin, our skin gets darker. If our body makes too little melanin, our skin gets lighter. Vitiligo is a condition that causes patches of light skin. Albinism is a genetic condition affecting all of a person' skin. Infections, blisters and burns can cause lighter skin.

Millions of people develop skin pigmentation conditions at some point in their lives. For many, this results in emotional distress and embarrassment. Things can go awry with almost any aspect of the human body, but when something happens to your skin, it can be very noticeable. On the bright side, the change people see is often the worst symptom of skin pigmentation problems.

The use of digital image features may help in an objective follow-up study of skin pigment disorder progression and test the efficacy of therapeutic procedures. Currently, there is no objective method in assessing the therapeutic response of skin disorder treatment. A global assessment of therapeutic response is made by the physicians using a scoring system based on an ordinal scale for which Physician's Global Assessment (PGA) is one example. The scale is based on the degree of repigmentation within lesions over time and an example is shown in Table 1. PGA is largely dependent on human eye and visual judgment to produce the scorings. Therefore it is a highly subjective method of assessment as inter-rate and intra-rate variation is inevitable.

Table 1: Physician's Global Assessment Scale

Repigmentation	Scale
0-25%	Mild
26-50%	Moderate
51-75%	Excellent
76-100%	Complete

It is found that related researches employ various approaches for analyzing the skin pigment disorder in digital imaging.

In 2004 authors A. Diplaros, T. Gevers and N. Vlassis proposed "Skin detection using the EM algorithm with spatial Constraints" [8] a color-based method for skin detection and segmentation, which also takes into account the spatial coherence of the skin pixels. They treated the problem of skin detection as an inference problem. They assumed that each pixel in an image has a hidden binary label associated with it, that specifies if it is skin or not. In order to solve the inference problem, they used a variational EM algorithm which incorporates the spatial constraints with just a small computational overhead in the E-step.

In the year 2008 Ahmad Fadzil M H, Hermawan Nugroho, S. Norashikin, H.H. Suraiya described in his paper "Assessment of Therapeutic Response in Skin Pigment Disorder Treatment" an image analysis technique that objectively measure skin repigmentation for the assessment of therapeutic response in skin disorders treatments.

Abbas Cheddad, Joan Condell, Kevin Curran and Paul Mc Kevitt have proposed in their paper "A Skin Tone Detection Algorithm for an Adaptive Approach to Steganography" that Luminance is underestimated since it is seen as the least contributing colour component to skin colour detection. new colour space which contains error signals derived from differentiating the grayscale map and the non-red encoded grayscale version. The advantages of the approach are the reduction of space dimensionality from 3D, RGB, to 1D space advocating its unfussiness and the construction of a rapid classifier necessary for real time applications. The proposed method generates a 1D space map without prior knowledge of the host image.

In 2011 Guoliang Yang, Huan Li; Li Zhang and Yue Cao in their paper "Research on a Skin Color Detection Algorithm Based on Self-adaptive Skin Color Model" [1] have proposed a reliable color modeling approach based on the fact that color distribution of a single-colored object is not invariant with respect to luminance variations even in the Cb-Cr plane and does not ignore the influence on luminance Y component in YCbCr color space.

2. SYSTEM DESIGN

The main elements of proposed system are a CMOS camera, microcontroller, LCD display. Fig.1 shows the block diagram of the system.

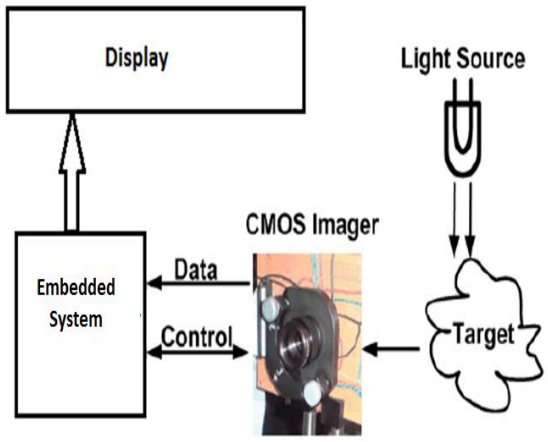

Fig 1: Block diagram

2.1 Microcontroller

The Microcontroller used in the system is AVR Atmega16. The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture.

Features

- 16K BYTES of In-System Programmable Flash
- 512 BYTES of In-System Programmable EEPROM
- 1K Bytes SRAM
- Analog Comparator
- Watchdog
- SPI
- 2 8-bit Timers plus prescaler
- 16-bit Timer with extra features
- 4 PWM
- 8 channel 10-bit ADC
- UART
- SPI
- 2-wire byte orientated serial interface
- Low power and Idle modes, External and External interrupts, selectable on-chip Oscillator

Fig 2: Microcontroller AVR Atmega16

2.2 CMOS Camera

A digital still or video camera that uses a CMOS-based image sensor chip rather than a CCD to record the picture. The CMOS image sensors enable the integration of all required camera circuits onto the same chip, making them well suited for tiny cameras such as in PDAs and cellphones. Initially used in less expensive devices, the quality of CMOS sensors has improved steadily, and they have been incorporated into professional cameras.

Some features of CMOS imager are:

- offers more integration i.e. more functions on the chip
- lower power dissipation at the chip level
- smaller system size
- low power consumption
- have devoted intense effort to achieving high image quality
- requires fewer components

Fig 3: CMOS Camera

2.3 LCD Display

A liquid crystal display (LCD) is a flat panel display, electronic visual display, video display that uses the light modulating properties of liquid crystals.
Its features are:

- 16×2 Characters
- Black on Green background
- Backlight
- 5v Supply
- Size: 80 mm X 36 mm X 13.5 mm
- Screen: 64.5 mm X 13.8 mm
- Low Power Consumption
- Compatible with Arduino 4 Bit LCD Library

Fig 4: 16x2 LCD Display

2.4 RS232

RS-232 is defined as the "Interface between data terminal equipment and data communications equipment using serial binary data exchange." This definition defines data terminal equipment (DTE) as the computer, while data communications equipment (DCE) is the modem. A modem cable has pin-to-pin connections, and is designed to connect a DTE device to a DCE device. The serial port is used to convert each byte to a stream of ones and zeroes as well as to convert a streams of ones and zeroes to bytes. The serial port contains a electronic chip called a **U**niversal **A**synchronous **R**eceiver/**T**ransmitter (UART) that actually does the conversion.

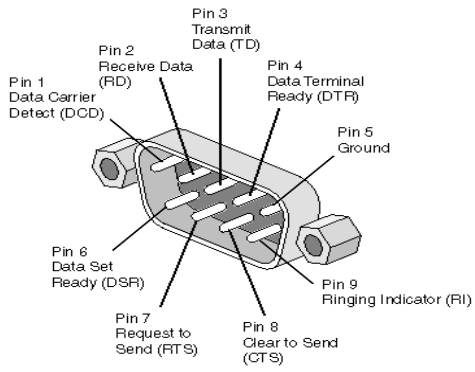

Fig 5: RS232 Pinout

Two alternative image sensors that can be used for optical molecular imaging systems are charge-coupled devices (CCDs) and CMOS imagers. CCDs must remain cooled in order to increase their sensitivity to low-level light for biomedical applications. Also, CMOS image sensors consume less power, operate at higher speeds, and offer much higher levels of integration. The advances in deep submicron CMOS technologies have made CMOS image sensors a practical alternative to the long dominating CCD imaging technology. One of the main advantages of CMOS image sensors is that they are fabricated in standard CMOS technologies, which allow full integration of the image sensor along with the processing and control circuits on the same chip at a low cost.

Fig. 1 shows a block diagram of the CMOS imager setup, where the CMOS imager is controlled by the embedded system i.e. microcontroller board through the expansion slot and the image settings, such as integration time, averaging or correlated-double sampling, could be adjusted by the switches on the board.

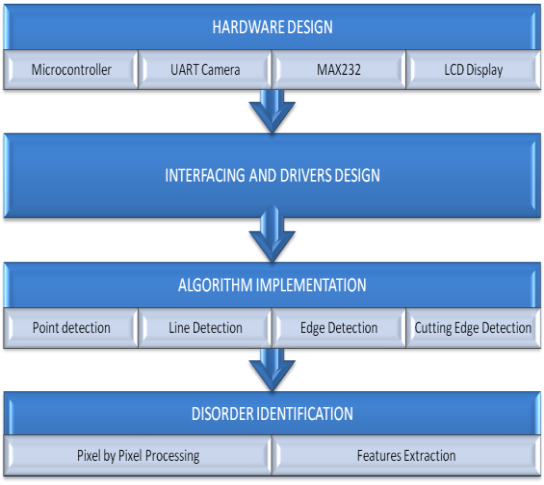

Fig 6: Flow diagram

The flow of all procedure is as shown in fig.6. Which consist of hardware design using all hardware units. Then interfacing al the devices. After that Algorithm implementation, where point detection, line detection, edge detection and cutting edge detection algorithms are most important. At the last stage there is identification of skin disorder based on some pattern matching, pixel by pixel processing and features extraction.

3. CONCLUSION

Skin pigment disorders cause the irregular pale patches of the skin. The disorders occur due to the abnormality of melanin production. The use of digital image analysis in this research enables the objective assessment of repigmentation progression and evaluation of efficacy of therapeutic procedures. A global assessment of therapeutic response is made by the physicians using a scoring system based on an ordinal scale for which Physician's Global Assessment (PGA) is one example. In order to determine repigmentation progression objectively, the conversion of RGB images to melanin related skin images is essential.

4. REFERENCE

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