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Research Article

INFRARED HAND VEIN DETECTION

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A B S T R A C T

The use of infrared radiation for the medical diagnosis is a very new concept in the field of medical technology that promises to deliver high end results**.** Vein identification is one of the most recent research topics in biomedical examination. In any surgery, the first important phase is an insertion of an intravenous (IV) catheter. The major problem faced by the physicians is difficulty in accessing vein for IV drug delivery or taking blood samples for test. In case of children, adults, critical care patients etc. It is very difficult task. Unnecessary puncturing of veins occurs due to poor visibility. Wrong puncturing may lead to many problems such as bruises, wounds, rashes, blood clot or permanently damage the vein.Our aim is to develop a low cost vein detection system, which uses infrared technique to capture vein images, process these images and display them on screen. This type of system will provide an easy access to the doctor for efficient drug delivery.

INTRODUCTION

The vein detector is aimed at solving the efficiency basedrequirement of a physician or a lab technician to identify and inject at the proper point in the circulatory system the required antidote. The device is aimed as a low cost solution abling layman to inject in their own body or to a target patient the required antidote without any prior knowledge of locating the vein. The vein pattern is not observable under the visible light. The vein pattern can be detected with help of infrared sensors. There are two different techniques such as far infrared imaging technique (FIR) and near infrared imaging technique (NIR) In any surgery, the first important phase is an insertion of an intravenous (IV) catheter. The major problem faced by the physicians is difficulty in accessing vein for IV drug delivery or taking blood samples for test. In case of children, adults, critical care patients etc. It is very difficult task. Unnecessary puncturing of veins occurs due to poor visibility. Wrong puncturing may lead to many problems such as bruises, wounds, rashes, blood clot or permanently damage the vein. To overcome this difficulty of vein detection we propose a new technique which consists of a ring of Near Infrared (NIR) Light emitting diodes and a camera to capture the image of the vein structure. This complete procedure helps the doctors in detecting 0the suitable veins for vein puncture. The two key characteristics of this device are portability and low cost.

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METHODOLOGY

System Architecture

Human eyes can only detect visible light that occupies a very narrow band (400 - 700nm) of the entire electromagnetic spectrum. However, there is much more information contained in other bands of the electromagnetic spectrum rejected by the objects of interest. For human vein patterns on the periphery, the visibility under normal visible light conditions is very low. Infrared is a non-invasive technique and is capable of capturing subcutaneous veins, i.e. veins on the surface of skin. Hence, by far it is the best method known for capturing vein images. Therefore, by exposing the subject's vein to infrared illumination of a specific wavelength, vein images can be captured and analysed. Biologically, there is a "medical spectral window" which extends approximately from about 700 to 900 nm, where light in this spectral window penetrates deeply into tissues, thus allowing for non-invasive investigation. Therefore, typically, the wavelength of the infrared light beam coming out from a light source is selected to be within the near infrared region with wavelength around 850nm. Using this wavelength, it also avoids undesirable interference from the IR radiation (3um - 14um) emitted by the human body and the environment.

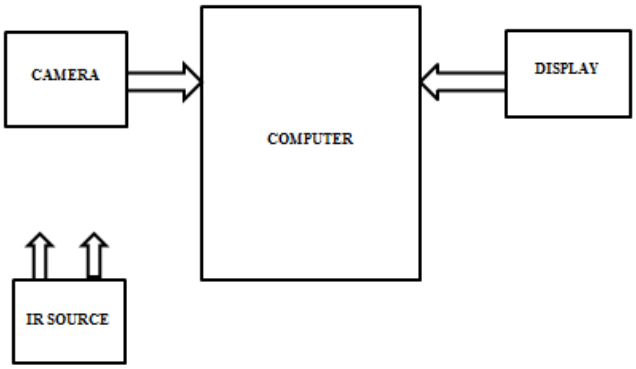


Fig 1 System Block Diagram

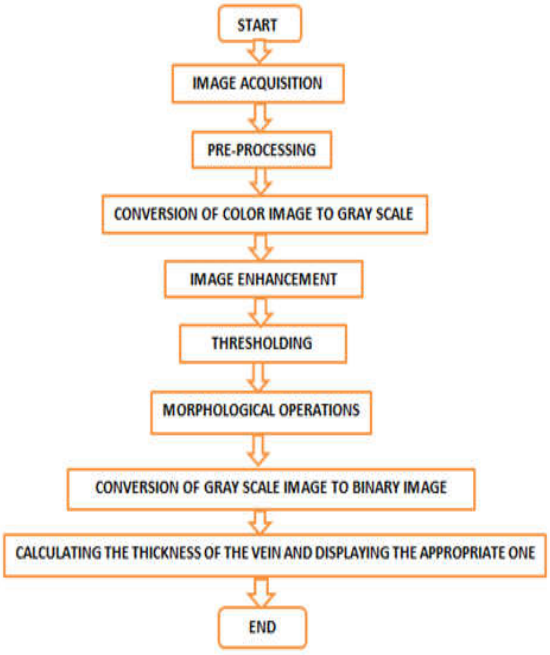
Description

1. IR SOURCE – We will be using an IR ring of leds which will act as the source.

This IR source is used for illumination.

2. CAMERA – A smartphone is used for capturing the image of the vein. The captured images are then processed to enhance the vein image.

Flowchart



Description of Algorithm

The algorithm initially includes obtaining of the image of the hand through a 5 MP camera. This image obtained is pre-processed i.e. it is re-sized and cropped according to the need. Since the obtained image is a color image we convert it to a gray scale image so that the operations can be performed easily on this type of image. Several operations like median filtering and CLAHE have been performed to enhance the image. This also helps in reducing the noise in the image. In order to partition properly between the foreground and the background, Thresholding has been performed. Thereafter, in order to process the image (veins) on the basis of their shape and features, morphological operations like dilation and erosion have been performed. This image is finally then converted back to Binary image.

Lastly, the thickness of each of the vein is calculated and the vein is the most thickness has been displayed. This vein is the appropriate one through which the injection of catheter (needle) should take place.

RESULTS

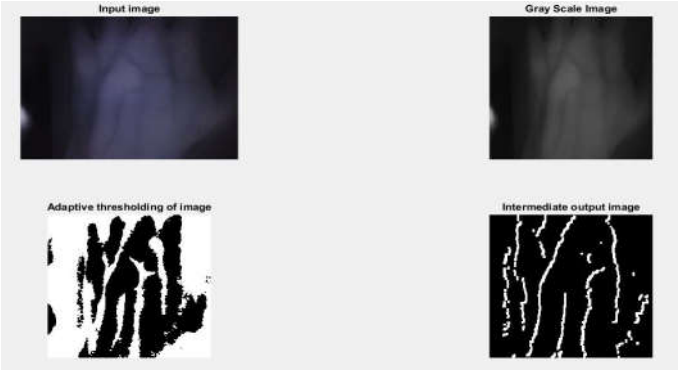


Fig 3 Intermediate Output

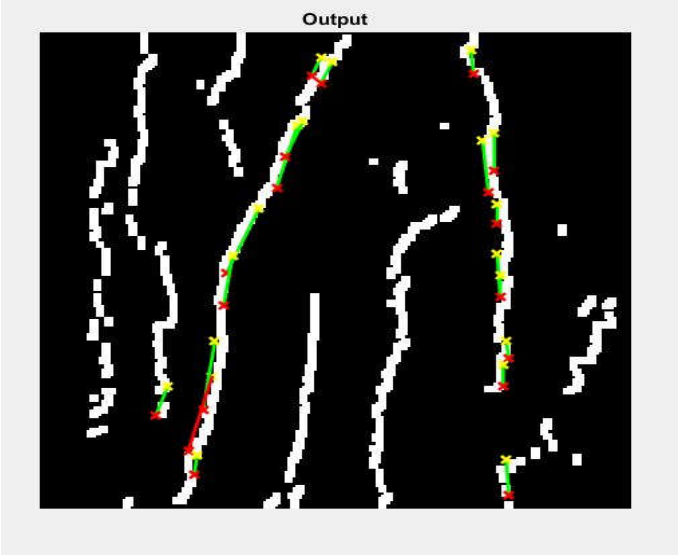


Fig 4 Final Output

CONCLUSION

Our goal is to obtain a portable efficient non-invasive vein detection system of low cost. This system consists of an IR source, a camera and a personal computer. Using this system, the blood veins in the hands were visualized. We could also obtain the transillumination images of the hand and using image processing algorithms we have extracted the desired vein for catheter injection. A lot of study on subjects such as age, skin tone and type has been made. This type of system will enable us to reduce the pain caused due to pricking and will also accurately determine the required vein for fluid injection.

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