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# A LOW COST VEIN DETECTION SYSTEM USING CAMERA DEVICES

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***Abstract: There has been a lot of discussion and research recently on vein detection equipment. This paper presents such a solution in form of a vein detection system using an infrared light emitting diode [LED] illumination array and image processing. the infra-red imaging techniques are providing great support to the diagnostics in the medical field .***

***Index Terms: Infrared LED, IR camera, Image Processing.***

## I. INTRODUCTION

The vein detector is aimed at solving the efficiency based requirement 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 to inject in their own body or to a target patient the required antidote without any prior knowledge of locating the vein. The basic need of any surgical procedure is insert the catheter in the body for taking a sample of blood and insertion the liquid medicine. But most of physician having a problem in that procedure. Especially in the new born baby, drug addicted persons and very old age person. If the physicians do unnecessary puncturing on the body of patient there is infection to the body. On this problem some device are introduce like Accuvein, but major problem is high cost of that instrument. . They are hence unaffordable by general physicians and medical practitioners who regularly administer intravenous injections

## II. PRINCIPLE

Basically 2 types of infrared imaging system
1. FIR (Far Infrared) 2.NIR(Near Infrared)
The basic phenomenon we are use in detecting the veins is that Near Infrared (NIR) radiation of the wavelength in between the region of 740 nm-760nm is able to detect veins but not arteries .Because of selective absorption of infrared radiation in blood vessels. The reason for using this phenomenon is the fact that the deoxidized hemoglobin [deoxy-Hb or Hb] in the veins almost completely absorb the radiation while the oxidized hemoglobin [HbO] in the arteries become almost transparent. Mainly we use two basic optical coefficients are involved in this absorption process,
1.Absorption coefficient ($\alpha a$,)
2. Scattering coefficient ($\alpha s$). The absorption coefficient $\alpha a$ determines how far light can travel before losing its intensity and, the scattering coefficient $\alpha s$ determines how far light can travel before losing its original phase and changing direction.

## III. WORKING OF A PROJECT

The model involves an external attachment to the camera to allow the vein viewing. When the system is switched on an infrared pass filter in front of the camera lens allowing only infrared viewing through the camera lens. For Infrared pass filter remove IR filter of ordinary camera instead of that IR filter we placed negative photographic film. Photographic film work as photo filter. The infrared array is also switched on which results in diffused infrared illumination over the skin surface. Now, as this is an invisible light range the vein image will not experience interference with ambient light as the infrared pass filter only allows infrared light to pass. The camera can hence see only the incoming infrared reflected light at the said wavelength. This results in a perceived motion of the presence of veins as minor tolerance on the skin in the image. The photographs can be seen in real time and also recorded using normal video or image capture function.

## IV. HARDWARE IMPLIMANTATION

In hardware part mainly 3 part are taken in consideration
1. Image Acquisition 2.Image Processing 3.Image display.

*A. Image Acquisition:* IR source and IR camera built up the image acquisition part.2For image acquisition IR source is required as shown in figure 1 .In hardware implemanation,theIR filter of USB based Intex webcam 305c camera has been removed so that camera only sense the IR light having 700-900μm range. In Images Processing two aspect are taken in consideration .
1.For capturing the images of veins camera sensor is used .
2.NIR source must be used to detect a proper vein pattern.

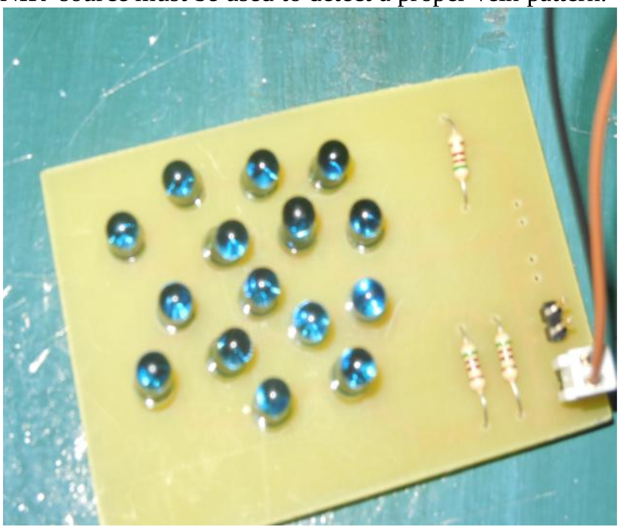


Fig no.1(pcb design)

In fig.2shows that the hardware implementation of system.

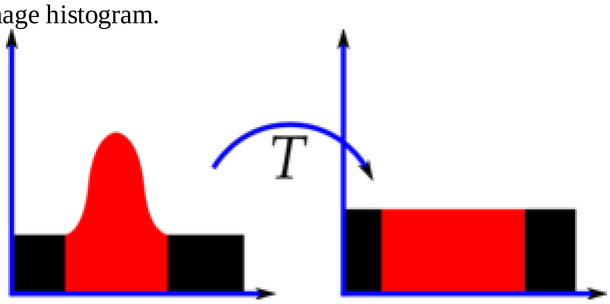

FIG.NO.2(HARDWARE SETUP)

## V. IMAGE PROCESSING

For image processing we used MatLab R2014a software. Image are more contrast by using image proseesing.in the image acquisition process,images are less brighter or invisible in same region .Therefore image enhancement is more important. We have experimented two image processing algorithms i.e.
1.Histogram Equalization(HE)
2.Contrast Limited Adaptive Histogram Equalization(CLAHE)

### *A. Histogram Equalization(HE)*

Various enhancement schemes are used for enhancing an image which includes gray scale manipulation, filtering and Histogram Equalization (HE).Histogram equalization is one of the well-known images enhancement technique. It became a popular technique for contrast enhancement because this method is simple and effective. Histogram equalization is a method in image processing of contrast adjustment using the image histogram.




Histogram is a useful tool to analyze the brightness and contrast of an image. It shows how the intensity values of an image are distributed and the range of brightness from dark to bright. An image can be enhanced by remapping the intensity values using the histogram. Also, histogram is used to segmented an image into the several regions by thresholding. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. The method is useful in images with backgrounds and foregrounds that are both bright or both dark. A key advantage of the method is that it is a fairly straightforward technique and an invertible operator Histogram equalization will work the best when applied to images with much higher color depth than palette size, like continuous data or 16-bit gray-scale images.

## VI. ENHANCEMENT

Image enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interest in an image. when we increase the contrast of an image and filter it to remove the noise "it looks better." It is important to keep in mind that enhancement is a very subjective area of image processing. In DSP, we store the number of pixels (frequencies) of same intensity values into a histogram array, which is commonly called "bin". For an 8-bit grayscale image, the size of histogram bin is 256, because the range of the intensity of 8-bit image is from 0 to 255.

*Implementation*

Consider a discrete grayscale image{x}and let ni be the number of occurrences of gray level i. The probability of an occurrence of a pixel of level i in the image is

$$Px(i) = p(x = i) = \frac{ni}{n}, 0 \le i \le L$$

*L* being the total number of gray levels in the image (typically 256), *n* being the total number of pixels in the image, and $Px(i)$being in fact the image's histogram for pixel value i, normalized to [0,1].Let us also define the cumulative distribution function corresponding to $p_x$ as which is also the image's accumulated normalized histogram. We would like to create a transformation of the form $y = T(x)$ to produce a new image $\{y\}$, with a flat histogram. Such an image would have a linearized cumulative distribution function (CDF) across the value range, i.e.

$$cdfx(i) = \sum_{j=0}^{i} Px\,(j)$$

which is also the image's accumulated normalized histogram. We would like to create a transformation of the form $y = T(x)$ to produce a new image $\{y\}$, with a flat histogram. Such an image would have a linearized cumulative distribution function (CDF) across the value range.

$$cdf\ y(i) = iK$$

The properties of the CDF allow us to perform such a transform ; it is defined as

$$cdfy(y') = cdfy\big(T(k)\big) = cdfx(k)$$

where *k* is in the range [0,L). Notice that T maps the levels into the range [0,1], since we used a normalized histogram of {x}. In order to map the values back into their original range, the following simple transformation needs to be applied on the result:

$$y' = y.(\max\{x\} - \min\{x\}) + \min\{x\}.$$

*2. Contrast Limited Adaptive Histogram Equalization (CLAHE)*

Adaptive histogram equalization (AHE)is a computer image processing technique used to improve contrast in images. It differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore suitable for improving the local contrast. However, AHE has a tendency to over amplify noise in relatively homogeneous regions of an image. A variant of adaptive histogram equalization called contrast limited adaptive histogram equalization (CLAHE)prevents this by limiting the amplification. Ordinary histogram equalization uses the same transformation derived from the image histogram to transform all pixels. This works well when the distribution of pixel values is similar throughout the image. However, when the image contains regions that are significantly lighter or darker than most of the image, the contrast in those regions will not be sufficiently enhanced. Adaptive histogram equalization (AHE) improves on this by transforming each pixel with a transformation function derived from a neighbourhood region. In its simplest form, each pixel is transformed based on the histogram of a square surrounding the pixel The derivation of the transformation functions from the histograms is exactly the same as for ordinary histogram equalization: The transformation function is proportional to the cumulative distribution function (CDF) of pixel values in the neighbourhood. CLAHE seems a good algorithm to obtain a good looking image directly from a raw HIS image, without window and level adjustment. This is one possibility to automatically display an image without user intervention. Further investigation of this approach is necessary.CLAHE was originally developed for medical imaging and has proven to be successful for enhancement of low-contrast images such as portal films.The CLAHE algorithm partitions the images into contextual regions and applies the histogram equalization to each one. This evens out the distribution of used grey values and thus makes hidden features of the image more visible. The full grey spectrum is used to express the image. Contrast Limited Adaptive Histogram Equalization, CLAHE, is an improuve version of AHE, or Adaptive Histogram Equalization. Both overcome the limitations of standard histogram equalization. While performing AHE if the region being processed has a relatively small intensity range then the noise in that region gets more enhanced. It can also cause some kind of artifacts to appear on those regions. To limit the appearance of such artifacts and noise, a modification of AHE called Contrast Limited AHE can be used.

## VII. RESULT

By using CLAHE algorithm we get above result.

## VIII. CONCLUSION

The concept has been successfully implemented on MatlabR2014a and presented in this paper. It is low cost, non-invasive type of instrument, which is very useful for physicians. Also use 2 algorithms for image enhancement in which images are morecontrast and sharpen. By using this algorithm images are more better visible to naked eyes.

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