IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

Volume 10, Issue 1, January 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.122

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

Enhancement of Foggy Images using Dark Channel Prior and Guided Filter Method

Alka Srivastava[1], Rajat Kumar[2]

Assistant Professor, Dept. of ECE, Saroj Institute of Technology and Management, Lucknow, India[1]

PG Student, Dept. of ECE, Saroj Institute of Technology and Management, Lucknow, India[2]

ABSTRACT: Images are being digitally transmitted across places, in vast numbers at an incredibly high rate. Digital Images are thus prone to a number of transmission challenges like fog or haze. Dark Channel Prior algorithm has been previously used as a common algorithm for hazy images recently introduced. In this research, we proposed a hybrid approach incorporating the previous dark channel approach with the directed filtering process. The hybrid algorithm was used by the software platform MATLAB and tested with qualitative and quantitative success measurements. The test was carried out on a variety of parameters of the algorithm proposed. A variety of test images were used to assess the method's output. The suggested hybrid algorithm has been carefully compared. The obtained results showing that the PSNR changes to about 10 dB and the correlation coefficient impacting the 1-mark for nearly all images greatly increase the performance of the modified algorithm. Of various test items, we even provided visual content contrasts.

KEYWORDS: Image processing, Fog model, Dark channel prior algorithm, Guided filter algorithm.

I.INTRODUCTION

In today's world, digital image processing is widely used and essentially obligatory. Improvement of image and information extraction is two important digital image processing components. An abstraction of information helps to acquire statistical information regarding some particular attribute or part of the picture. The method of image improvement helps to improve visibility of any part or characteristic of the image that removes information in other parts or features.An image is better or not, this concept may differ from person to person. For one, a bright image is very best but for other it can benot that good so there is no hard and fast rule to check the quality ofan image peculiarly by its visual appearances. But the issue of noise which gets combined to an image while capturing or sendingit from one device to another device, may be reduced to a large range. Moreover, contrast regulation is also a way which proves to be a cogent tool for improvement in image perceptibility. So image enhancement by applying various algorithms and techniques make an image individually appears better than the input. In the speech recognition, HDTV, medical image processing, video processing applications by changing the intensity pixel of an image, image enhancement can be modified.

1.1 Image Processing Overview

Digital Image Processing requires manipulating digital images to enhance image accuracy by using a computer. Digital image processing is a wide variety of subjects which often includes methods that can be complicated mathematically, but it is very straightforward. The preparation helps to make information extraction and further studysimpler, detailed and logical points of importance.The digital images will be transferred to a computer, and these data will be interpreted using sequence of equations and the effects of computation will be processed for every pixel. Such tests create a permanent digital image that can be viewed, registered or accessed by other computer applications. It is a new digital image. In reality, there are countless ways of digital image manipulation.

Today, there are a wide variety of and evolving sources of digital imagesdue to to low- effective computer hardware and software and cost efficient gadgets, while, a decade ago, the principle and reality of digital image processing were at the beginning and even digital computers cost so much, their computer performance was much lower than the current norm. The optical image sources range from commercial geoscopic instruments such as an airborne microscope,airborne solid-state camera and satellites to a high-resolution video camera.

1.2.Enhancing the Image

The word enhancement implies a way to increase the visual appearance of an image. The main concept of improvement is to make interest, attractiveness and desirability more or more desirable. A program for image creation consists of a series of methods to improve the visual clarity of the image or to change an image into a type that is better

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

used for human or computer study. The primary aim of an image enhancing method is to process an image so that the result is more suitable for certain uses and applications than the original image. Photo Editing transforms images so that the nuanced information is best reflected. In an image enhancement process, the faithfulness of a reconstructed image in relation to an ideal type of image is enhanced without any concerted effort as done during the image reconstruction.

Image Enhancement Techniques:

As image processing is a vital area, and there is always a space for improvement in lieu of accomplishing better efficiency and clearer, brighter and contrasted image. Out of different techniques available, main classification is made into:

1. Spatial domain methods
2. Frequency domain methods

Fig.1 shows the various types into which image enhancement techniques can be divided into.

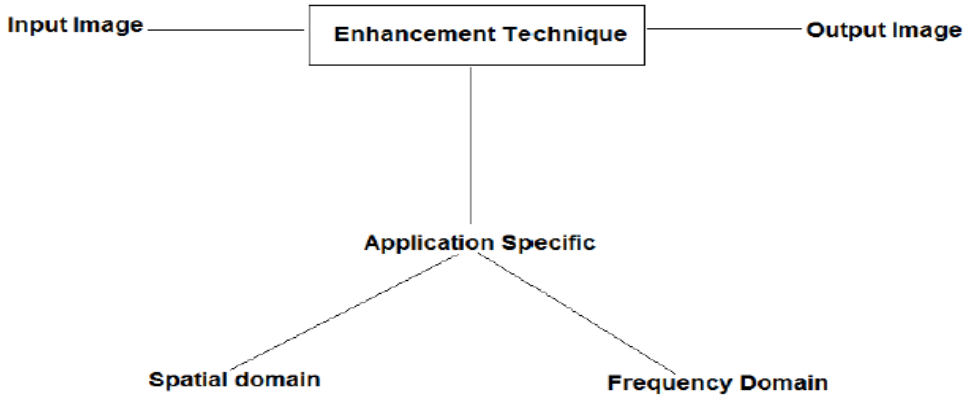


Fig.1: Techniques of Image Enhnacement

II.LITERATURE REVIEW

Sos Agaian et.al[1] proposed in this paper is histogram transformation, but the optimum point must be determined. This means that, while working best, strategies that can be favoured are slower than some, less computationally difficult. This complexity has contributed to the development and demonstration of logarithmic transform histogram matches. It offers a mix of increased power and machine performance.

Ismail A.et. al. defined as a mixture of Histogram Equalisation methodology and the Quick Gray Level Groupings, the proposed new approach for automated contrast enhancement imaging is describable. Mean square error and absolute mean luminosity error in the pictures used. To boost comparison, the proposed approach can be carried out entirely automatically. Experimental findings demonstrate the successful and solid enhancement and development of the new approach for specific images relative to the actual application of each methodology.The study demonstrates that by statistical visual measures and image analyzes of the Peak Signal-to - Noise Ratio, the concept developed provides the best possible output.

Magudeeswaran et. al. [3], proposed fuzzy histogram-based equalization method for the improvement of image contrast. In comparison with other standard approaches for various gray and natural color images, the visual improvements tests of the proposed FHE algorithm have improved. The FHE provided best results for qualitative and quantitative tests, despite the simulation results received.Experimental FHE algorithm frameworks produce greater performance than normal techniques like histogram equalization; brightness conservation in bi-histogram equalization; minimum mean bibliographic equalization of brightness errors; and brightness preservation for variouscolor pictures of a complex fused histogram. Experimental tests demonstrate that the suggested approach will remove the washed off looks successfully and dramatically and adverse artifacts produced by other processes. This approach is simple and only applicable for electronic consumer goods.

Mohammad Farhan Khan et. al. [4], proposed two innovative Multi-HE approaches, namely SDDMHE-M and SDDMHE-D. The innovation of the approaches introduced is the complete scaling of small segments and the

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

standardization process. The methods suggested lead to an extended histogram of the rendered image, but in around the same form as the input image. the following In histogram segmentation, these approaches vary , depending on either average or minimum intensities.The suggested methods often reduce the issue of saturation intensity and enhance the consistency of the image output by avoiding inconsistent bucket distribution in the histogram performance. The simulation results demonstrate that while preserving the transparency and the true nature of the images, the approaches recommended increase contrast to the drawback of the system.

Naina Dhingraet.al. [5], introduced an algorithm was developed to boost three sets of observed and underexposed images experimentally. The proposed DWT (no enhancement), DWT + Gamma improvement and DWT + Histogram Equalization are compared to the presented algorithm. The picture fused provides finer information and is easier to see. Entropics and standard deviations are used in the unbiased evaluation of the image fusion algorithm dependent on DWT, fluid enhancement and PCA variations with the morphologic analysis, increase the image fusion efficiency and could be the potential pattern in image fusion science.

Konda Jeevani, K Anusudha[6] recommended a image-enhancing fuzzy logic approach that has provided better and more effective output than normal improvements.In contrastto prior upgrades, the metrics attained are even more attractive. The machine time taken by the fugitive strategy is also smaller.

Chin Yeow Wonget. el. [7],proposed a framework is being developed and introduced by a variety of studies utilizing qualitative and quantitative measurements such as gradient, entropy, hue, brightness and saturation to increase hue images consistency. The application of optimally chosen hyperbolic tangent profiles suppresses the desired objects during histogram equalization. This boosts image quality; improve contrast and sharpening the color images without compromising on brightness and saturation.

Ce Li Yang et. el. [8], this study states a newly introduced process for improving images based on fuzzy Sure entropy limit. Two primary benefits can be realized by such a method. First, in low-quality images, particularly low-contrast and low-light images, it is incredibly accurate and convenient. Second, the approach suggested is rather robust, as the threshold value may be assigned in a moderately broad range before the outcomes are adequate.

Anil Singh Parihar, et. el. [9], these authors recommends an intensity transfer function that converts a level of intensity on the basis of its spatial location and intensity of the signal. Based on image contextual features, FCCE presents both local and global improvement of contrast. The key benefits of the new algorithms are the intensity of the system and the under enhancement issue may not emerge, FCCE employs both global and local implementation so that if the outcomes become actual artifacts with visual quality. It's computational-effective.

An image improvement Algorithm for images compressed using the JPEG norm has been introduced by Jinshan Tang et al. [10] the study focuses on a contrast measure established in the DCT domain. The benefit of the algorithm were 1) the algorithm does not influence the distortion of the original image as it improves the image in thedecompression phase, and 2) Each DCT image compression type such as JPEG, MPEG2, and H.261 is compatible with this introduced algorithm .

III.METHODOLOGY

The images taken in the foggy weather tend to appear blurred or hazy as there is always slight lack of visibility and claritycaused by breakup and absorption of atmospheric particles. Such images can not be used for any kind of further processing in their original form and require some high level of processing techniques to remove the hazy appearance and make them as clear as possible for viewing. In recent years several scholars have performed extensive work into approaches and strategies for addressing issues related to the removal of haze images, which prevents the use of a single haze-image.The focus of this research is therefore to enhance the appearance of foggy images by using “dark channel prior” method as the first step to account for atmospheric absorption and scattering of camera light. Guided Filter is used post Dark Channel Prior method for better enhancement, thus making it a hybrid approach.

3.1 Fog Model:

The action of light in a camera is defined by simple physics laws. In the meantime, fog removal involves foggy areas to be observed in an original picture, and a fog removal that can be defined as a method of fog removal from fog-affected areas, according to their amount of fog. Light coming from a light source is scattered towards the

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

camera and causes a shift in colour. Also, light reflected off an object is attenuated by the atmosphere, including dust particles and water. The distance between an object and the camera increase these phenomena.
In the fog model equation, an I(x) input representing fog is modelled as:

$$I(x) = J(x)t(x) + A(1 - t(x))(3.1)$$

"J(x)" reflects the final image of fog added, where "I(x)" is an image taken with a sensor.'A' is a global fog value representing the degree of fog effect on all pixels, 't(x)' is a transmission value indicating the degree of effective camera images capture without color dispersion, and 'x' is pixel sign.
He et al [12] have picked 0.1% of the highest pixels on the dark channel for calculating "A." The highest intensity pixels in I(x) are chosen as a global fog attribute among these pixels. The t(x), as seen in the following equation, is an exponential pixel depth decay function:

$$t(x) = e-\beta d(x) \quad (3.2)$$

If the "β" coefficient of scattering and "d(x)" indicates the distance to the camera from the target.
The further the object, the less information is transmitted to the camera, because the degree of dispersion is that and because of the fog value A, which is expressed more, the color of the fog itself appears stronger.Fog deletion is then intended to restore J(x) with the aid of "A and" t(x) "from" I(x). In Equation 3.1 the first term on the right suggests a simple attenuation, indicating how the light actually enters the camera lens and the second term reveals that, before reaching the camera lens, it has air energy released by suspended particles.

3.2 Dark channel Prior Algorithm

The Dark Channel Prior algorithm was used for this work to approximate the distance between the camera and the target. Dark Channel Prior uses a statistical feature study of a regular image that converges to zero at least one of an RGB color values of pixels from a flawless area.The most critical factor of transmission estimation is the approximate distance between the object and the subject of equation 3.2. "Jdark(x)" is seen in the following equation in the dark pixel field, x from every foggy area — value(x):

$$Jdark(x) = cmin \in (r,g,b) \min y \in \Omega(x)(Jc(y)) \quad (3.3)$$

Where the "Ω(x "corresponds to the surrounding location with centre at "x," and "y" to the "Ω(x)". "Jc(y)" means any pixel value of the "y" array. The dark channel "Jdark(x)" converges to zero from the anti-fog field.
It is possible to obtain equation (3.4) by conversion (3.3) into (3.1) as the fog meaning "A" is less than 0 in pictures "I(x)" influenced by fog.

$$t(x) = 1 - \omega \times cmin \in (r,g,b) \min y \in \Omega(x) Ic(y)Ac \quad (3.4)$$

Where "ω" is the fog weight.
The obtained transmission (3.4) does therefore not correspond with the input image bottom, as in the local field a minimum value was calculated. A processing method to boost the product is then required for the transmission.
From Equation 3.1 a dehazed image can be derived as follows:

$$J(x) = I(x) - Amax(t(x), t0) + A \quad (3.5)$$

Where "t0" corresponds to the transmission's low boundary and has a [0.1–0.03] value. The noise in the restored image will be suppressed if the value of "t(x)" is too high, because "J(x)" produces a very large degree of noise.

3.3 Guided Filter Algorithm:

The directed filter is a filter based on optimisation intended to minimize noise and fluidity. The filter takes a "I" as a guiding image and a "p" is a depth image giving a filter output "q" as a linear overlay of the filter guide:

$$qi = akIi + bk, \forall i \in \omega k \quad (3.6)$$

Here the picture based on pixel "ωk" is a window and the pixels "k," and "ak" and "bk"are constants which link the pictures and pi is the pixel within the image. The difference between pixel is expressed in the form of a cost function in order to minimize the difference between the input and the output value.

$$(ak, bk) = \Sigma i \in \omega k(qi - pi)2 + \epsilon ak2) = \Sigma(akIi + bk - pi)2 + \epsilon ak2i \in \omega k)(3.7)$$

The additional word "ϵ" is applied so that the vector "ak" is not too large and the input picture does not become redundant.
In the understanding that in some windows, output pixel qi is used ak, $bk$is altered in many windows. We use all the ak and bk values as average to overcome this, so our final filter output is:

$$qi = 1/|\omega| \ \Sigma(akIi + bk)\ k{:}i \in wk = ai'\ Ii + bi \quad (3.8)$$

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

3.4 Proposed Hybrid Algorithm:

The proposed algorithm combines both the dark channel prior enhancement technique and the guided filter technique. Fig. 2 shows the block diagram of the proposed technique. The input image is hazy or foggy obtained from internet sources. It is resized to an acceptable level as a preprocessing step. It is passed through dark channel prior estimation to obtain the dark channel out of the three channels i.e. red,green and blue. The dark channel thus obtained is passed through atmospheric lighting estimation step. The image thus obtained is processed to obtain the transmission estimate. This concludes the dark channel prior step. The hybrid algorithm includes application of guided filtering on the dehazed image obtained from the dark channel prior method. The result thus obtained is visually enhanced and improved in terms of quantitative parameters.

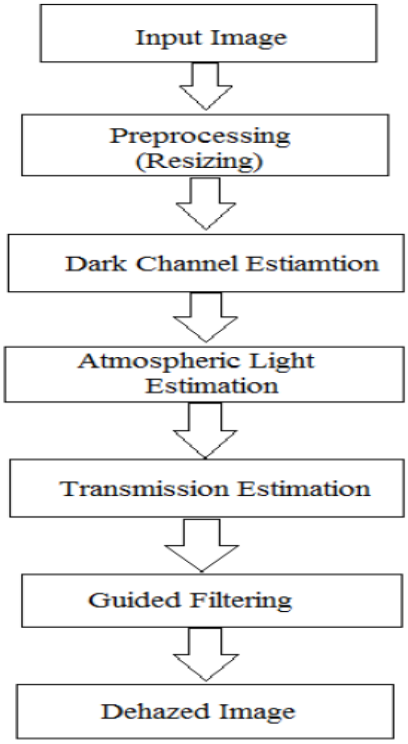


Fig. 2 Proposed Hybrid Algorithm

The Trust-Worthy algorithm sets a ranking barrier that must be overcome to gain competitive advantage. It allows the usage of the usable spectrum. Nodes which are able to readily navigate their way to accessible licensed channels without affecting the primary device increases. It indicates that it has considerable ability to turn the different network conditions into an efficiency improvement.

IV. RESULT AND DISCUSSION

The proposed method has been soft coded and evaluated on a number of images containing haze or foggy appearance. The dataset is comprised of various images in different conditions and scenes so to obtain a wide analysis on different kinds of lighting conditions and atmosphere.

For any image processing algorithm related to enhancement of image quality, the evaluation is both qualitative and quantitative. While the qualitative method is purely based on abstraction of human visual perceptibility, which requires a thorough research and validation on a large number of human populations, the quantitative methods are based on some predefined metrics to evaluate the performance of any algorithm. Some of the popular performance evaluation metrics in image processing domain are Peak Signal Noise Ratio, Contrast gain and Number of Changing Pixel Rate and Structural Similarity Index measure.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

4.1 Qualitative Evaluation

Fig 3 shows the dataset images which have been used for the analysis and evaluation of the algorithm. The images are of different resolution and pixel sizes and thus give a wide range of applicability of the proposed algorithm.

(a)

(b)

(c)

(d)

(e)

(f)

Fig. 3 Dataset Images a) Forest b)Fruits c)Train d)Satellite e)Decidous f)Highway

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

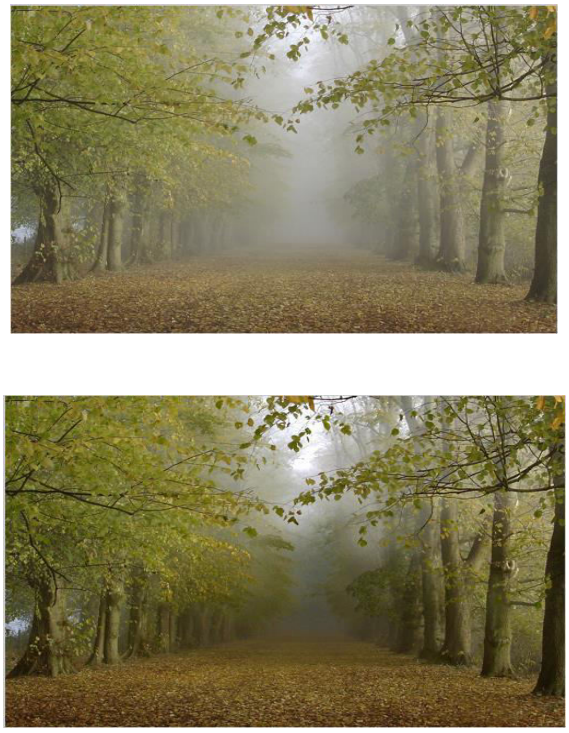


Fig. 4 Forest Image Results

Fig. 4 shows the results for "forest" image. As can be seen post application of proposed method the quality of the image is enhanced and haze/fog is removed.

Fig 5Fruits Image Results

Fig 5 shows the results on fruit image. The visual perceptibility has increased to acceptable level.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

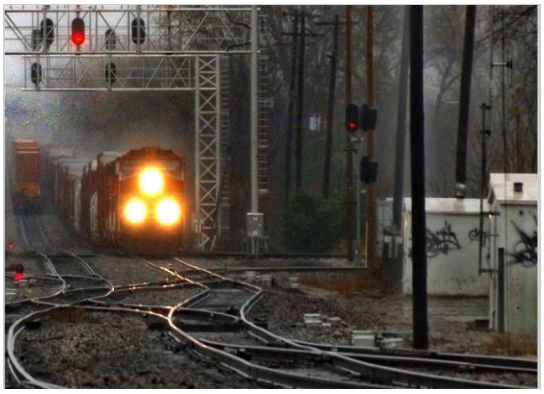


Fig 6Train Image Results

Fig. 7Map Image Results

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

Fig. 6 shows results on “Train” image. Fig. 7 shows the results on the Satellite “Map” image.

Fig. 8Decidous Image results

Fig. 8 shows the results obtained from applying the proposed method on the “deciduous” image.

Fig. 9Highway Image Results

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 1, January 2021||

DOI:10.15662/IJAREEIE.2021.1001013

As can be observed from Fig. 9 the foggy image of "Highway" is substantially improved in visibility on the application of algorithm.

VI.CONCLUSION

In this research work the image dehazing and enhancement problem has been taken into consideration. Images are being transmitted digitally at very rapid pace and in large amounts nowadays. The images are infected by noise while transferring, often affected by unclear view like fog or haze. Dark Channel prior has been a popular image dehazing algorithm implemented recently for hazy images. A new hybrid method to remove haziness in an image has been proposed which combines the dark channel prior method with the directed filter method. The MATLAB software has been used to create a software application which will satisfy the suggested requirements. The evaluation of the proposed algorithm was conducted on the Mean Square Error, Peak Signal to Noise Ratio, Contrast Gain, and SSIM.

Evaluation experiments have been performed, and the suggested approach has proven successful. A comparison of the proposed hybrid algorithm has been given. The results obtained show a that there is considerable improvement in the performance of the improved algorithm with the PSNR improving to about 10 dB and the correlation coefficient touching the 1 mark for almost all the images. We have also showed visual quality comparisons for various test images.

Future Work:

The work done in this research work has considered Gaussian noise addition to the clean images and then performed the dehazing process. Further research can be directed towards obtaining realtime implementation to apply the given algorithm to see the effectiveness of the method to enhance the image. Another future research paradigm can be to apply the algorithm belonging to different fileds such as medical images, satellite images etc.

REFERENCES

[1] Sos Agaian and Karen Panetta,"Transform Coefficient Histrogram Based Image Enhancement Algorithm using Contrast Entropy",IEEE Transactions on Image Processing, Volume: 16, Issue: 3, March 2007 .

[2] Ismail A. Humied *, Fatma E.Z. Abou-Chadi, Magdy Z. Rashad (2012) "A new combined technique for automatic contrast enhancement of digital images", Egyptian Informatics Journal (2012) 13, 27–37.

[3] V. Magudeeswaran1and C. G. Ravichandran2 (2013) "Fuzzy Logic-Based Histogram Equalization forImage Contrast Enhancement",Hindawi Publishing Corporation (2013) Article ID 891864.

[4] Mohammad Farhan Khan∗, Ekram Khan, Z.A. Abbasi (2014), Segment Dependent Dynamic Multi-Histogram Equalization for Image Contrast Enhancement", Elsevier Journal of Digital Signal Processing 25 (2014) 198–223

[5] Naina Dhingraa,*, Amita Nandala, Meenu Manchandaband Deepak Gambhirc (2015), Fusion of Fuzzy Enhanced Overexposed and Underexposed Images", Elsevier Procedia Computer Science 54 (2015) 738 – 745.

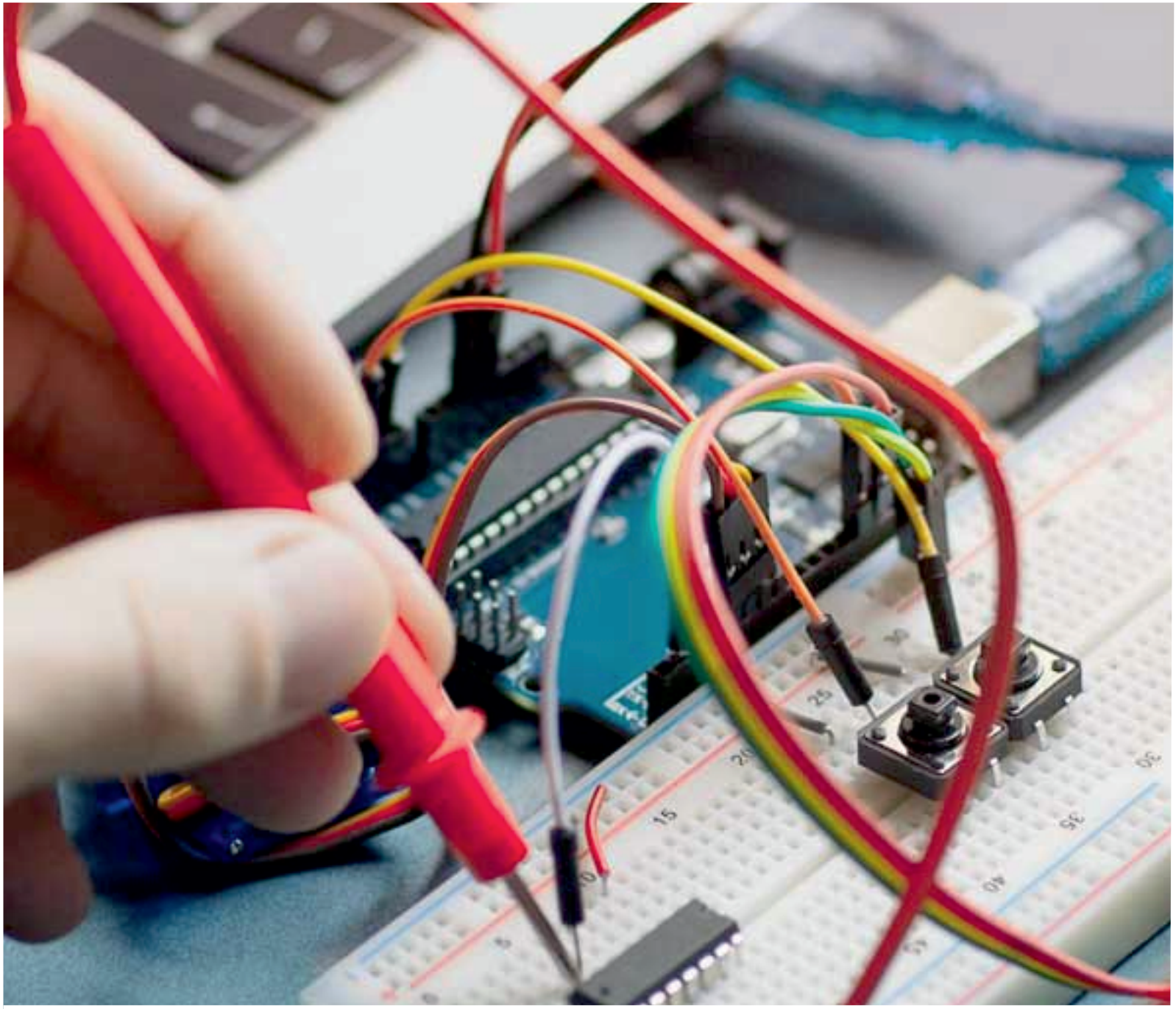
[6] Konda Jeevani, K Anusudha, "A Fuzzy Logic Based Approach to Enhance Low Contrast Images", 2015 International Conference on Control, Instrumentation, Communication and Computational Technologies (lCCICCT).

[7] Chin Yeow Wonga, Guannan Jianga, Md Arifur Rahmana, Shilong Liua, Stephen Ching-Feng Lina,Ngaiming Kwok a,d,*, Haiyan Shib, Ying-Hao Yuc,TonghaiWud,"Histogram equalization and optimal profile compression based approach for colour image enhancement", 2016 Elsevier J. Vis. Commun. Image R. 38 (2016) 802–813.

[8] Ce Li, Yang, Yang Limei Xiao, Yongxin Li, Yannan Zhou, Jizhong Zhao, "A Novel Image Enhancement Method using Fuzzy Sure Entropy", Neurocomputing 215 (2016) 196–211

[9] Anil Singh Parihar, Member, IEEE, Om Prakash Verma, Member, IEEE, and Chintan Khanna, "Fuzzy-Contextual Contrast Enhancement", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 26, NO. 4, APRIL 2017

[10] Jinshan Tang, Eli Peli, and Scott Acton, Senior Member, IEEE, "Image Enhancement Using a Contrast Measure in the Compressed Domain", IEEE SIGNAL PROCESSING LETTERS, VOL. 10, NO. 10, OCTOBER 2003.



INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor:
7.122

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

9940 572 462 6381 907 438 ijareeie@gmail.com

www.ijareeie.com

Scan to save the contact details