International Journal of Engineering and Techniques - Volume 4, Issue 3, May - June 2018

RESEARCH ARTICLE OPEN ACCESS

# Angle Detection Using Wavelet Transform Using Image Processing

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## Abstract:

The present trend in intuitive administration mechanical autonomy is the improvement of advancements designed for less demanding activity by novice human clients, e.g., utilizing back-drivable robots , where gravity compensation is given, alongside impedance alteration, with the goal that the client can educate by physically moving the robot end-impact or by hand, as opposed to programming the robot to do particular errands. Different applications incorporate circumstances where a machine should be prepared to take after a coveted trajectory in a dull situation, e.g., pick-and-place tasks in an assembling setting, or possibly preparing a functioning prosthesis amid a mobile cycle. The significant commitment of this examination is a reversal based way to deal with gather the human purpose (i.e., what trajectory the human is attempting to accomplish) and utilize it to choose the information refresh for enhancing yield following. This can be accomplished regardless of whether the human does not have the adequate mastery to accomplish yield following with the machine—gave the human can keep up the stability of the shut circle system

*Keywords:* **Angle detection, Image processing, wavelet transformation, Haar transform, image segmentation, enhancement.**

**INTRODUCTION**

Image processing is a method to play out a few tasks on an image, with a specific end goal to get an upgraded image or to separate some valuable data from it. Image processing is a type of signal processing with input as an image and yield might be image or characteristics/features related to that image. These days, image processing is among quickly developing advances. It frames center research region inside engineering and software engineering disciplines too.

Image processing fundamentally incorporates the accompanying three stages:

- Importing the image using image procurement tools;
- Analyzing and controlling the image;
- Output in which result can be modified image or report that depends on image investigation.

There are two types of methods utilized for image processing in particular, simple and digital image processing. Simple image processing can be utilized for the printed copies like printouts and photographs. Image analysts utilize different basics of understanding while at the same time utilizing these visual techniques. Digital image processing techniques help in the control of the digital images by utilizing PCs. The three general stages that a wide range of data needs to experience while utilizing digital technique are pre-processing, enhancement, and show data extraction.

**One Dimension Signal**

The example of a one dimension signal is a waveform. It can be scientifically spoken to as

F(x) = waveform

Where x is an autonomous variable. Since waveform is a one dimension signal, so that is the reason there is just a single variable x is utilized. The pictorial portrayal of a one-dimensional signal is given underneath:

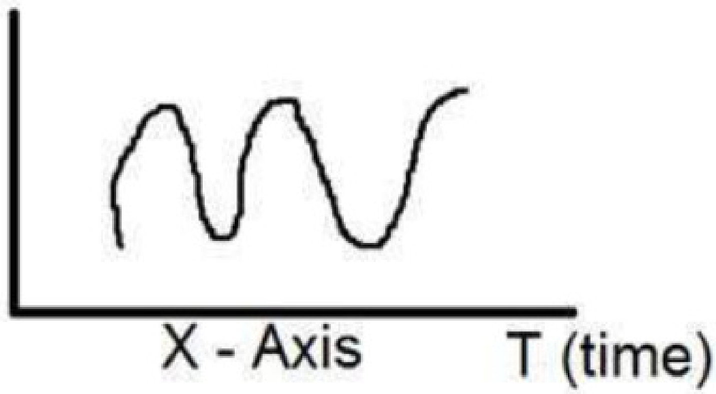


**Fig 1. One Dimensional Signal**

The above figure demonstrates a one-dimensional signal. Presently this prompts another inquiry, which is, even though it is a one-dimensional signal, at that point for what reason does it have two axes?. The response to this inquiry is that even though it is a one-dimensional signal, however, we are attracting it a two-dimensional space. Or on the other hand, we can state that the space in which we are speaking to this signal is two dimensional. That is the reason it would seem that a two-dimensional signal. The idea of one dimension all the better can be understood by taking a gander at the figure underneath.

**Fig 2. Concept Of One Dimension**

**Two Dimension Signal**

The example of a two-dimensional signal is an image, which has just been discussed previously.

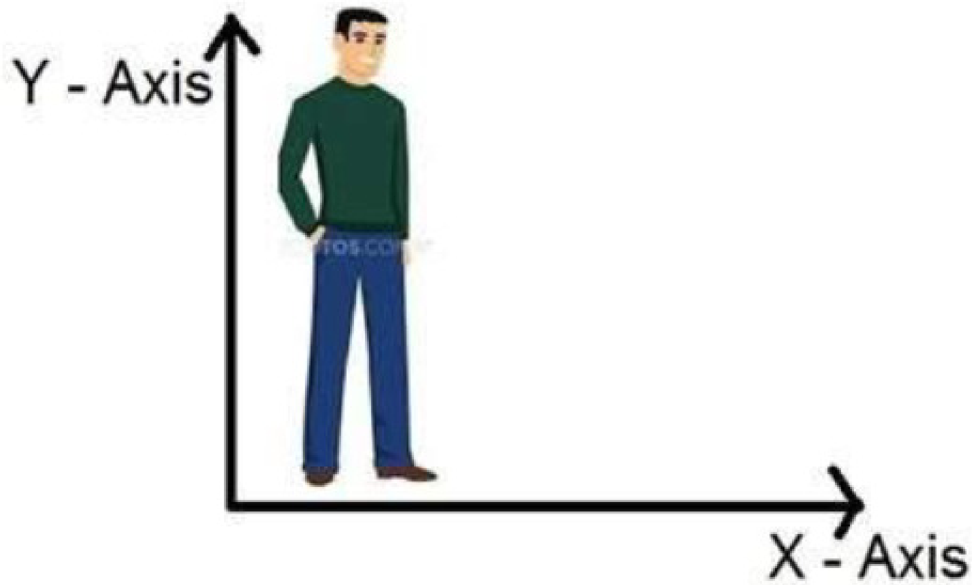


**Fig 3. Two Dimension Signal**

As we have just observed that an image is a two-dimensional signal, I-e: it has two dimensions. It can be numerically spoken to as:

F (x , y) = Image

Where x and y are two variables. The idea of two dimensions can also be explained regarding mathematics as:

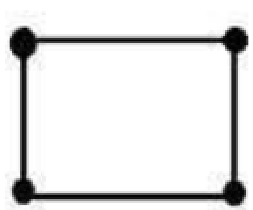

**Fig 4. Concept Of Two Dimension**

Presently in the above figure, name the four corners of the square as A, B, C and D separately. On the off chance that we call, one line segment in the figure AB and the other CD, at that point we can see that these two parallel segments sign up and make a square. Each line segment compares to one dimension, so these two line segments relate to 2 dimensions.

**Three Dimension Signal**

Three-dimensional signal as it names alludes to those signals which have three dimensions. The most well-known illustration has been talked about at the outset which is of our reality. We live in a three-dimensional world. This case has been talked about intricately. Another case of a three-dimensional signal is a solid shape or a volumetric data, or the most widely recognized illustration would be vivified or 3d cartoon character.

The mathematical representation of the three-dimensional signal is:

F(x,y,z) = animated character.Another axis or dimension Z is associated with a three dimension, which gives the illusion of depth. In a Cartesian co-ordinate system it can be seen as

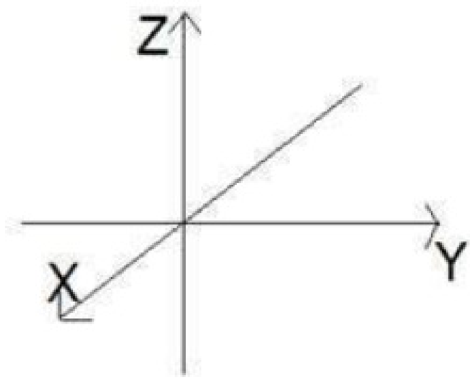


**Fig 5. Three Dimensional Signal**

**Four Dimension Signal**

In a four-dimensional signal, four dimensions are included. The initial three are the same starting at the three-dimensional signal which is: (X, Y, Z), and the fourth one is the T(time). Time is often represented to as temporal dimension which is an approach to quantify change. Scientifically a four dimension signal can be expressed as:

F(x,y,z,t) = animated movie.

The example of a four-dimensional signal is an animated 3d movie. As every character is a 3d character and afterwards they are moved as for the time, because of which we saw a hallucination of a three-dimensional film more like a genuine world.

**Methodology**

**Wavelet Transformation**

**Basic Ideas**

The Discrete Fourier Transform (DFT) might be thought of in general terms as a matrix multiplication in which the first vector k x is decomposed into a progression of coefficients n X. Both k and n are numbers

$$\begin{pmatrix} x_0 \\ . \\ . \\ x_{N-1} \end{pmatrix} = \begin{pmatrix} . & . & . & . \\ . & W_{kn} & . & . \\ . & . & . & . \\ . & . & . & . \end{pmatrix} \begin{pmatrix} X_0 \\ . \\ . \\ X_{N-1} \end{pmatrix}$$

which go over a similar value N.

In the above, we may derive the transformed coefficients *n X* by

inverting the matrix. The form of *a W* has numerous possibilities, however physically we would like the choice of forward and backwards transforms, i.e., an inverse should exist.

The Discrete Wavelet Transform (DWT) generates a matrix *in W*

Which is now frequently used for image compression without using the FT since it can confine preserve photographic detail such that a significant number of the coefficients might be disregarded (tantamount to filtering) and yet the reconstruction still effective. For specific kinds of issues the filtering might be significantly more aggressive than corresponding FT coefficient filtering.

DWT's are especially effective in dissecting waveforms which have spikes or pulses covered in noise. The noise might be more effectively evacuated than with FT filtering and the state of the pulses saved. Conservation of Energy like a Parseval theorem would likewise be decent.

**The Haar Transform To Get Wavelet**

Suppose for simplicity we assume an input vector xk with $0 < k < 7$. This is readily decomposed into an obvious basis set as shown.

$$(x_k) = x_0\begin{pmatrix}1\\0\\0\\0\\0\\0\\0\\0\end{pmatrix} + x_1\begin{pmatrix}0\\1\\0\\0\\0\\0\\0\\0\end{pmatrix} + x_2\begin{pmatrix}0\\0\\1\\0\\0\\0\\0\\0\end{pmatrix}\ldots + x_7\begin{pmatrix}0\\0\\0\\0\\0\\0\\0\\1\end{pmatrix}$$

In 1910 Haar proposed the following decomposition.

$$(x_k) = a_0\begin{pmatrix}1\\1\\1\\1\\1\\1\\1\\1\end{pmatrix} + a_1\begin{pmatrix}1\\1\\1\\1\\-1\\-1\\-1\\-1\end{pmatrix} + a_2\begin{pmatrix}1\\1\\-1\\-1\\0\\0\\0\\0\end{pmatrix} + a_3\begin{pmatrix}0\\0\\0\\0\\1\\1\\-1\\-1\end{pmatrix} + a_4\begin{pmatrix}1\\-1\\0\\0\\0\\0\\0\\0\end{pmatrix} + a_5\begin{pmatrix}0\\0\\1\\-1\\0\\0\\0\\0\end{pmatrix} + a_6\begin{pmatrix}0\\0\\0\\0\\1\\-1\\0\\0\end{pmatrix} + a_7\begin{pmatrix}0\\0\\0\\0\\0\\0\\1\\-1\end{pmatrix}$$

*H a* with the columns of H being simply the above basis vectors and the

*K an* obtained by matrix reversal of H.

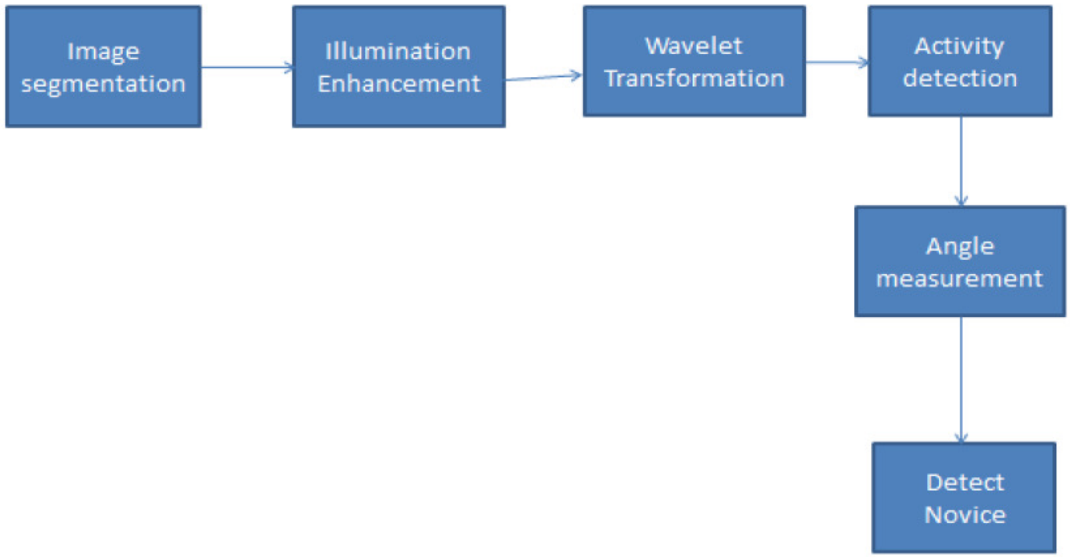


**Figure 6. Block Diagram**

**Image Segmentation**

Image segmentation is the way toward partitioning a digital image into multiple segments (sets of pixels, otherwise called super-pixels). The main aim of segmentation is to make simple and additionally change the portrayal of an image into something that is considered as important and less demanding to examine. Image segmentation is ordinarily used to find items and limits (lines, bends, and so forth.) in images. All the more definitely, image segmentation is the way toward allocating a name to each pixel in an image to such an extent that pixels with a similar name share certain characteristics.

The consequence of image segmentation is an arrangement of segments that all things considered covering the whole image or an arrangement of contours extracted from the image (see edge identification). Every one of the pixels in a region are comparable as for some characteristic or figured property, for example, color, intensity, or texture. Adjacent regions are fundamentally extraordinary as for the same characteristic(s). At the point when connected to a heap of images, normal in medical imaging, the subsequent contours after image segmentation can be utilized to generate 3D reconstructions with the help of interpolation algorithms like Marching cubes.

**Image Enhancement**

Image enhancement is the way toward adjusting digital images so the outcomes are more reasonable for show or further image examination. At the point when images are to be seen or prepared at multiple resolutions, the wavelet transform (WT) is the numerical tool of a decision. Wavelets are numerical functions that cut up data into various frequency segments and after that review every segment with a determination coordinated to its scale. They have points of interest over customary Fourier methods in dissecting physical circumstances where the signal contains discontinuities and sharp spikes. Wavelets were created autonomously in the fields of arithmetic, quantum physics, electrical engineering, and seismic geology. The Wavelet Transform gives a time-frequency portrayal of the signal. It was produced to beat the short happening to the

Short Time Fourier Transform (STFT), which can likewise be utilized to investigate non-stationary signals. While STFT gives a steady determination at all frequencies, the Wavelet Transform utilizes multiresolution technique by which diverse frequencies are examined with various resolutions.

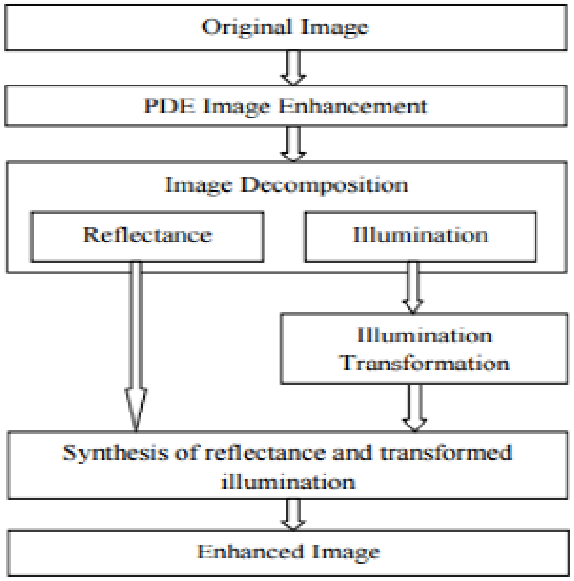


**Fig 7. Block Diagram Foe Image Enhancement**

**Pde Image Enhancement**

The main aim of the Pde Image Enhancement is to acquire the smoothed image. The input image is first taken. Discrete Wavelet Transform (DWT) is applied to decompose an image into low-high,low-low and high-high frequency bands respectively. Framelet filter is applied to find the mask value. By using this smooth the region of an image. Finally, PDE is applied to improve the smooth region. Partial differential equation (PDE) is a differential equation that contains unknown multivariable functions and their partial derivatives. PDEs are used to formulate problems involving functions of several variables

**Image Decomposition**

Image is decomposed into reflectance and illumination. Bright Pass Filter (BPF) is utilized to assess the illumination. From Retinex theory lightness is the result of reflectance and illumination. Illumination implies light cast on the surface of the scene. Reflectance implies surface reflects more than light than it gets.

**Illumination Transformation**

Naturalness Preservation is a nontrivial task with large illumination variations. By the by illumination typically changes slowly rather than the reflectance. Therefore, illumination variations primarily remain in the low-frequency band. Illumination variations can be overcome by removing low-frequency components. Here, the DCT is utilized to transform the illumination. The DCT can be utilized to transform an image from spatial domain to frequency domain. Low-frequency parts of an image can be expelled essentially by setting the low-frequency DCT coefficients to zero. The subsequent system works like a high-pass filter. Since illumination varieties are essentially low-frequency segments. Gauge the incident illumination on an image by utilizing low-frequency DCT coefficients. Setting the DCT coefficients to zero is equal to subtracting the result of the DCT fundamental image and the relating coefficient from the original image

**Synthesis Of Reflectance And Illumination**

To enhance details and preserve naturalness, the uniform illumination is considered. Weighted Fusion Method is utilized to synthesis the Reflectance and uniform illumination images both to get the final enhanced image. The outcome of the image is interesting. In Weighted Fusion Method, obtain the gradient field for each image. Compute the weighted function of each image by processing the gradient magnitude. The regions of high temporal variance between two images obtained by comparing the intensity gradients of accompanying pixels from the two images.

**Activity Detection**

The technique of detecting activities was performed in three steps: 1) **Data Collection:** I obtained the 3-dimensional acceleration data from the accelerometer on my Android phone. 2) **Feature Extraction:** I identified and extracted different features in the accelerometer data for each activity that I wanted to identify. 3) **Activity Classification:** I utilized the features extracted for the various activities to train the classifier. The classifier was then applied on new accelerometer data to detect the activity being performed.

**Detect Novice**

A Measurement Result holds about because of running an estimation investigate a test suite. It contains the estimation esteems, classes, and timestamps, and data about the functional test outcomes.

**Results:**

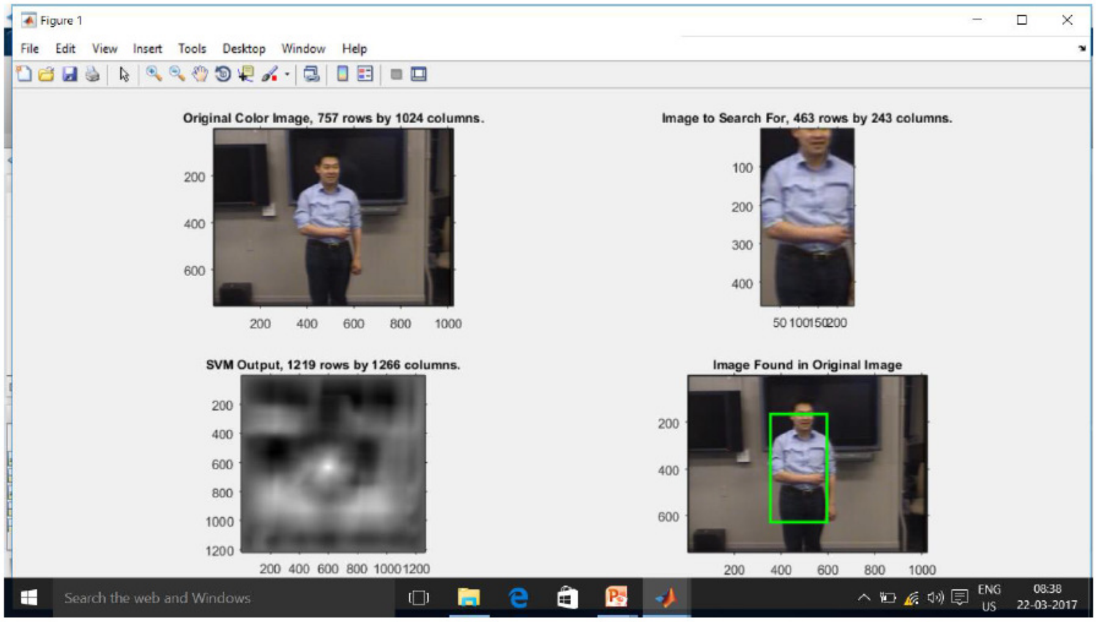


Fig 8. Enhance Feature

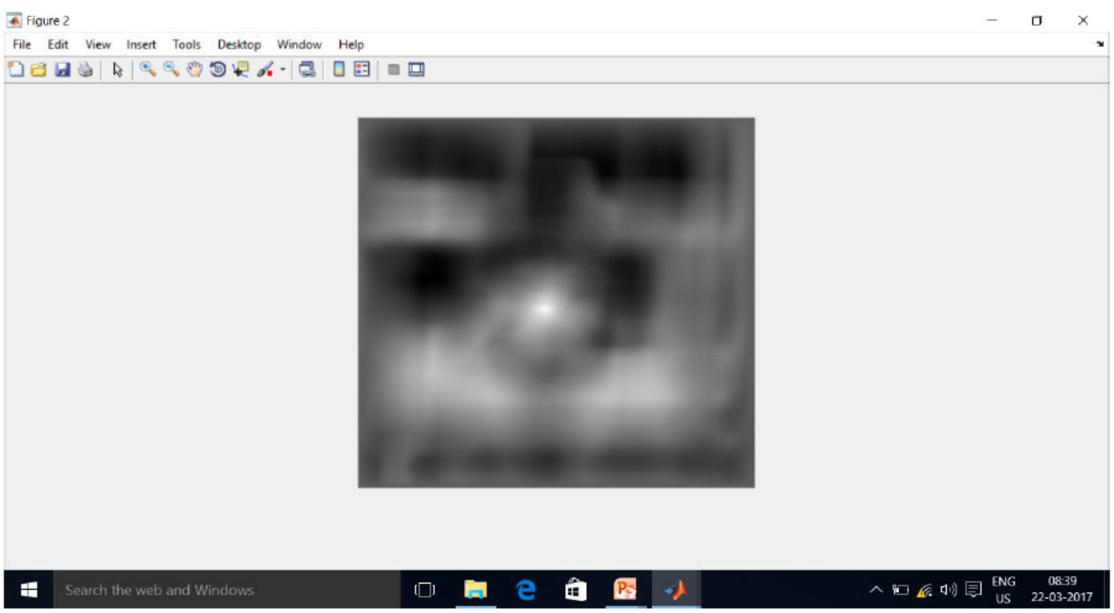


Fig 9. Feature extraction

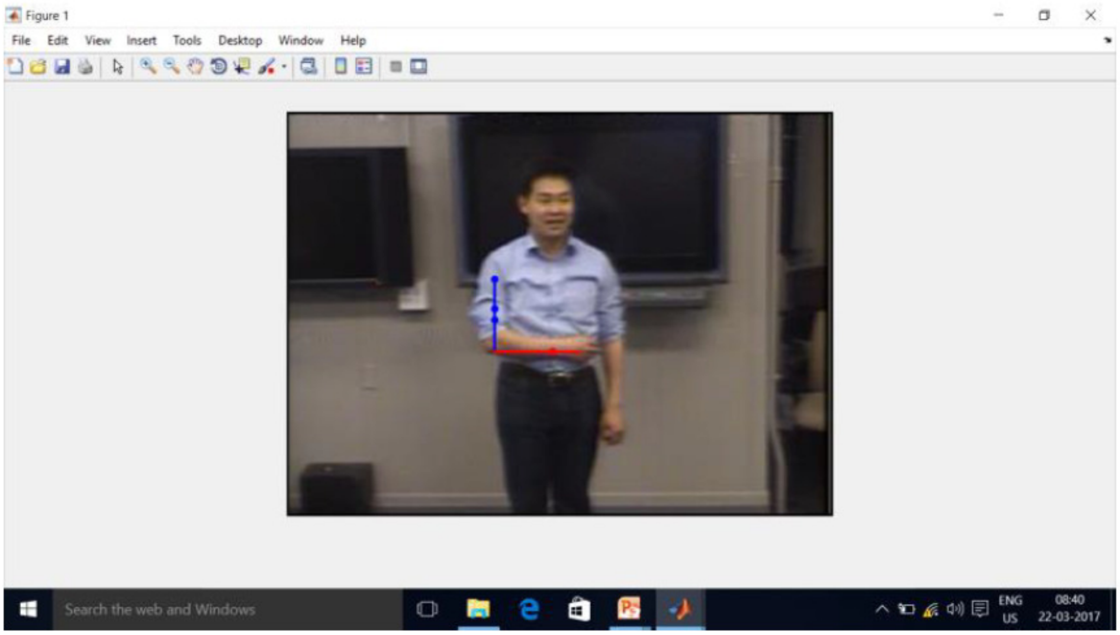


Fig 10. Degree Detection

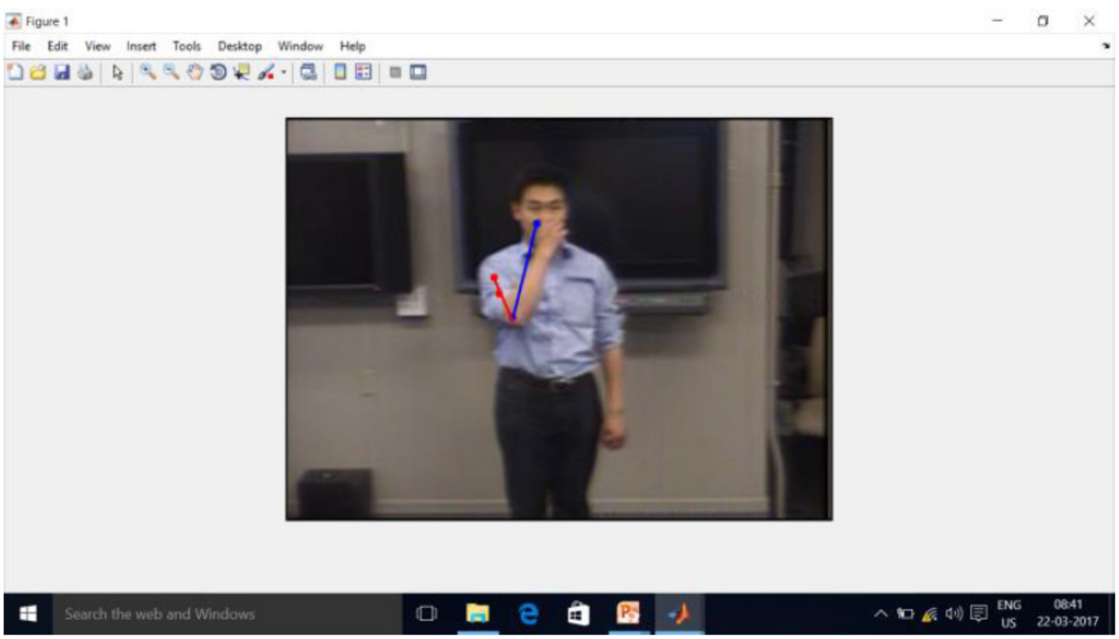


Fig 11. Degree Detection

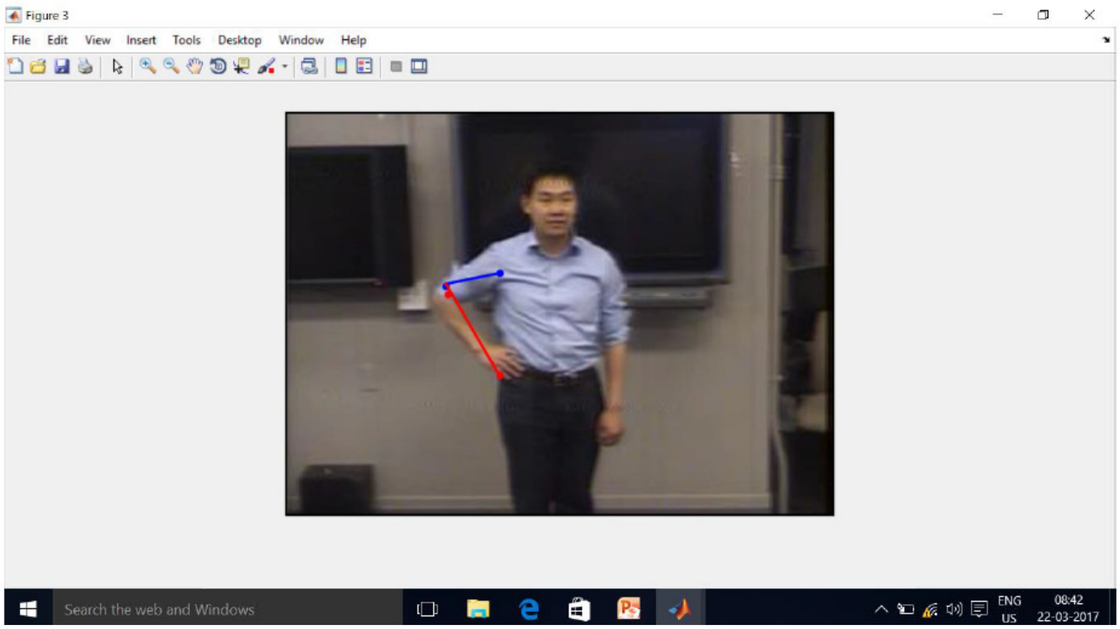


Fig 12. Degree Detection

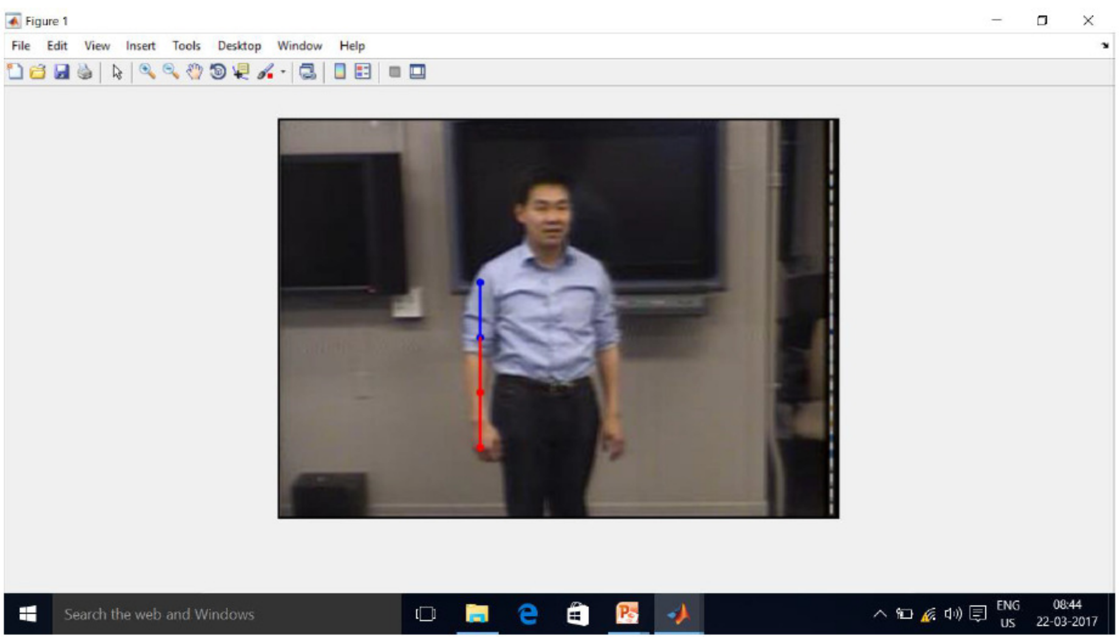


Fig 13. Degree Detection

**Conclusion**

So far the CCTV cameras are utilized to identify the novice conduct of a man. It can be identified simply after a couple of minutes. In our undertaking, the novice of a man can be identified promptly by the use of digital image processing. The angle is distinguished utilizing wavelet transformation technique. The coding is finished with the assistance of Matlab, and the reproduced yield is utilized as the contribution for the buzzer. On the off chance that a similar angle rehashes for more number of times then it is distinguished as the novice and the buzzing sound is watched.

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