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EFFICENT USE OF IRIS RECOGNITION TECHNIQUE AND BIG DATA TECHNIQUE FOR THE PURPOSE OF DEVELOPING SMART CITY

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Abstract: Iris recognition plays a significant role in human identification. It is an automated method of biometric identification. In literature, for the purpose of iris recognition Canny edge detection method is used. In certain other cases canny edge detector is combined with various other techniques such as Hough transform, Circular Hough transform and so on. In above mentioned cases, the system accuracy was comparatively less and noise is more. Due to above drawbacks, a new edge detection method based on fuzzy interference logic is used in the proposed work. In the proposed work the data gathered from iris is stored in the iris database and then these datas are used as input for the purpose of iris recognition. Initially input data are resized to certain value and are then edge detected using fuzzy interference logic algorithm and then features are extracted and are used for the purpose of matching. If a particular person found to be recognized then the person is allowed to enter into the city. In Smart city the person will be provided services by finding the user location. Smart service includes providing user necessary heat, ventilation and Air Condition based upon the requirement of the user. As Iris dataset is provide instead of finger print data it gives high degree of accuracy with less cost.

Keywords: Iris dataset, Fuzzy Interference logic, Feature Extraction, Particle Filter (PF), Importance Sampling (SIS).

I) INTRODUCTION

Image Processing deals with process of using image data for the purpose of acquiring necessary data. The input data for the image processing can be acquired from digital cameras. These digital cameras can be used easily with computers. Digital image Processing has acquired new dimension now a days.

Iris is an internal organ that is Protected against damage by a highly sensitive and a transparent membrane called cornea. Iris recognition is the best method of recognition by comparing with various other methods such as fingerprint, voice, signature and face recognition techniques. Fingerprints can be difficult to identify after certain years of labor.

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Huge amount of population in and around the world were already registered in iris recognition systems for the purpose of passport free automated border crossing and some national ID Programs. The main advantage of iris recognition system is its speed of matching with the features extracted and the features already in the database and it is extremely resistance towards false matches. Due to its accuracy, it can be used in various application such as mobile security, border crossing and certain other application.

Particle filter is used in nonlinear situations to find the location of the particular person. The location is identified by the amount of particle and its angle and time of arrival of the signal. The particle filter estimates the accurate location of the person and the services such as heat ventilation and air condition. Particle filter has a drawback in which some particle failure may take place, in such cases resampling of particle can be done to reuse the lost particles.

Smart city allows only authorized user to enter into the city and blocks those unauthorized people. This technique helps to reduce theft and un authorized access to certain areas without manual security.

2. RELATED WORKS

Amin Dehghani and Hamid Abrishami moghaddam proposed a histogram matching method for optic disc localization[1].In [2], Rubber Sheet Modulo Map annular iris texture method is used for iris recognition. In [3], employed an adaptive histogram equalization and median filtering to segment iris from an eye image.michal haindl and Mikulas Krupicka uses multispectral spatial probabilistic model and adaptive thresholding for the detection of iris from non-occlusion region[5].In[6], contour of iris boundary are detected by using radius vector function for iris recognition. Statistical moment is used for feature extraction in [7]. Canny edge detection and circular Hough transform are used for edge detection in [8],[10].In [9] One dimenstional Gabor wavelet transform is used for feature extraction. In [11]Jung Min Pak, Choon Ki Ahn (2015) implement an algorithm known as finite impulse response filter. The main use of this filtering techniques is to improve the reliability of indoor localization especially in wireless sensor networks. In this behaviour estimation error occurred so that types of errors are rectified by using auxiliary filter. In this work the author using Taylor approximation method is used to reduce the computational calculation in matrix. Pan Pan and Dan Schonfeld[12] (2008) mainly focused on tracking error present on true state and actual state on the tracking video data by the help of particle filter.M. Nicoli, C. Morelli, and V. Rampa et al., [13](2008) here the author invented grid based technique for reduce the indoor localization problem. This proposed work trace the multi path mobile position at the Ultra-Wide Band indoor space. In this the author had used Bayesian method apply ultra wide band localization in wireless sensor networks.In [14] Gabriel M. Hoffmann and Claire J. Tomlin et al., in this method the network size is to increased then only rapidly trace localization. The author had decided to done this work in mobile sensor network with particle filter to trace the object, but the particle computation coast is very high so avoid this the proposed method using parametric approximation method used to simulate the target search. Yogesh Rathi, Namrata Vaswani, and Allen Tannenbaum et al., (2007) in [15] this paper implement the particle filter and kalman filter algorithm to trace the object state that means each and every movement of the human body is tracking particle filter. Amadou Gning, Branko Ristic (2012) [16] in this work bayes filter is used to find the intervals of particle tracking.In this the author mainly reduce the number of particles count instead of this using particle box. Wonmo Koo, Sangkyung Sung (2009) [17] in this work the author compare the particle filter and extended kalaman filter. Among both filters, particle filter gives accurate solution.Zhonyu Pang, Derong Liu et al.,(2009), [18] In this work particle failure can be overcomed by resampling algorithm. Since resampling algorithm increases computational cost and hence minimum sample method is used here.Jung Min Pak, Choon Ki Ahn et al., (2016)[19],In this work is combine with finite

impulse response filter and a new proposed method composite particle filter. The ordinary particle filter is going to the failure state ,finite impulse filter used to recover the particle failure. This paper is not trace the human. Rickard Karlsson, Thomas Schon, et al.,[20] (2005) proposed equivalent flop measurement method for reducing the computational cost that occurs due to resampling.

3. PROPOSED WORK

The Proposed work uses iris for the purpose of authentication of individual as the fingerprint method of recognition provides many drawbacks. In the proposed work, there are two phases namely training phase and testing phase. In training phase, the datas are gathers from the user and are stored in the database and in testing phase the image to be tested is processed and the feature extracted from the particular image will be compared with already stored data and then matching will be done. If the Person is recognized, then the particular person will be allowed to enter into the smart city in which the particle that covers the person and its angle of arrival can be used to identify the location of the person. By finding the location of the person the necessary service can be provided to the user by using HVAC technique. Let us discuss the work more detailly.

Block diagram for Smart city development is Shown below.

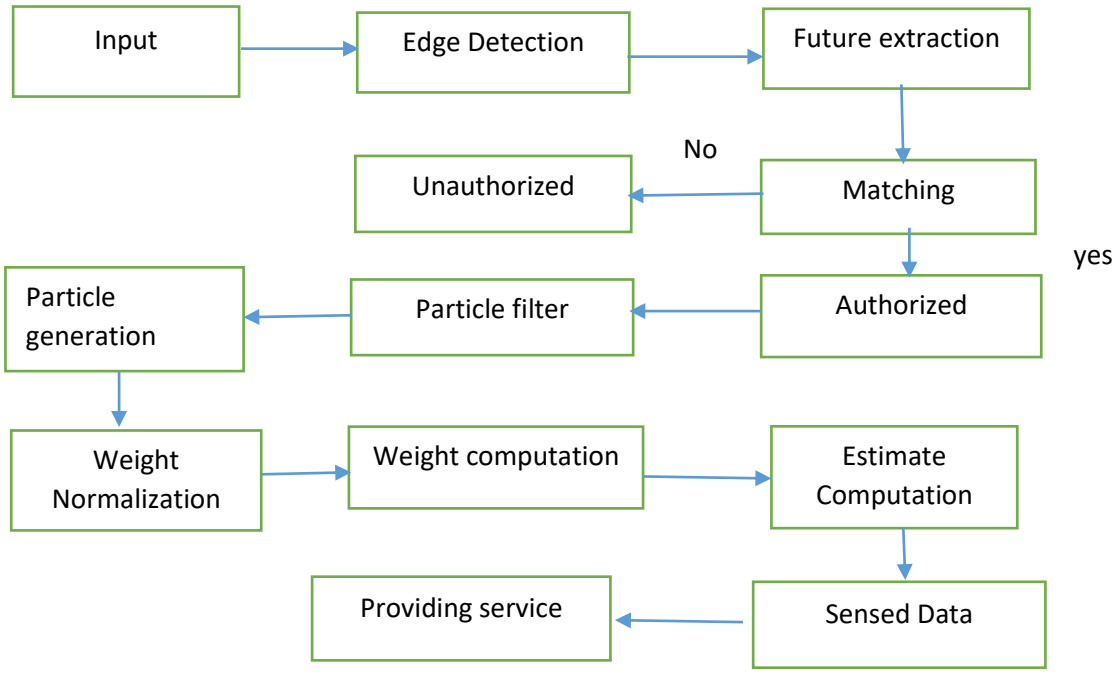

Fig. 3.1 Block Diagram of Smart City Implementation

3.1 PREPROCESSING

After the input image is selected, the image will be preprocessed. In preprocessing stage, initially the image is converted to gray scale for further processes. If the image is already in gray scale then no need for convertion of image. After converting the image into gay scale, Image resizing and Histogram equalization is done on the image

3.1.1 Histogram Equalization

After resizing the image, further the contrast of the image is enhanced using histogram equalization. Histogram equalization is the process used for improving the contrast of image by adjusting the image intensities. Let the given image be represented by the notation I, the pixel intensity

of image can be varied from 0 to L-1 ie, 256 possible intensity values. The image can be represented in matrix form as mc by mr matrix. Let p denote the normalized histogram of image I . then histogram equalization can be given by

$$pn = \frac{\text{number of pixels with intensity n}}{\text{total number of pixels}} \quad n = 0, 1, ..., L - 1 \tag{1}$$

3.2 SEGMENTATION

For the purpose of segmentation fuzzy interference logic is used. It detects almost all the edges in an image. Edges of the input image can be detected by using a window mask of 2*2 size and this mask will be slide over the entire input image. The Fuzzy Interference logic is implemented by considering four pixels namely X1, X2,X3 and X4 for input and produces one output variable.

The 2*2 mask used for Fussy interference logic (FIL) is shown below

X1	X2
X3	X4

Fig 3.2 Mask for fuzzy interference logic

In the first phase of the Fuzzy Interference System (FIS), the fuzzification of input is performed by defining two trapezoidal membership functions called Black and White. By evaluating these two membership functions, all the image pixel are classified into either black or white fuzzy set. After fuzzification, a rule based evaluation is done to get the output. A sudden raise between white and black pixel is classified as edge in rule based method of fuzzy interference system 10 no of rules has been applied to the input image to obtain the edge. The fuzzy interference rules depends on the weights of 3 neighbour values ie, X1,X2,X3 and X4 itself. These fuzzy outputs are combined using OR (max) operation.

Finally, the output of fuzzy set edge is then defuzzified to obtain desired output value. In this defuzzification is done by calculating the centroid. In rule based Fuzzy Interference logic (FIS) has the following 10 rules. In the final phase of the FIS, the output fuzzy set Edge is defuzzified to get a crisp set and the desired final output. Here the defuzzification operation is performed by calculating the centroid.

The 10 fuzzy rules in fuzzy Interference logic is given below

1. If the pixel X1 is black and pixel X2 is black and pixel X3 is black and pixel X4 is white then pixel X4 is an edge.
2. If the pixel X1 is black and pixel X2 is black and pixel X3 is white and pixel X4 is white then pixel X4 is an edge
3. If the pixel X1 is black and pixel X2 is white and pixel X3 is black and pixel X4 is white then pixel X4 is an edge
4. If the pixel X1 is white and pixel X2 is black and pixel X3 is black and pixel X4 is white then pixel X4 is an edge
5. If the pixel X1 is white and pixel X2 is white and pixel X3 is white and pixel X4 is black then pixel X4 is an edge

6. If the pixel X1 is white and pixel X2 is white and pixel X3 is black and pixel X4 is black then pixel X4 is an edge
7. If the pixel X1 is black and pixel X2 is white and pixel X3 is white and pixel X4 is black then pixel X4 is an edge
8. If the pixel X1 is white and pixel X2 is black and pixel X3 is white and pixel X4 is black then pixel X4 is an edge
9. If the pixel X1 is black and pixel X2 is black and pixel X3 is white and pixel X4 is black then pixel X4 is an edge
10. If the pixel X1 is black and pixel X2 is white and pixel X3 is black and pixel X4 is black then pixel X4 is an edge

3.3 FEATURE EXTRACTION

Feature extraction is the process of extracting feature from the edge detected image. Texture feature also plays an important role in accurate identification of images. Texture feature means which measures smoothness, coarseness, and regularity of pixel in an image

Mean

Mean or average can be defined as the sum of all elements in an image divided by number of elements in an image.

Mean = Sum of all the el ements in the image / Number of elements in the image

$$f(x,y) = \frac{1}{\text{mn}} \sum \text{g(r, c)} \qquad (2)$$

mn - mxn matrix

f(x,y) - mean

g(x,y) - Set elements

Variance

Variance is defined as the variation of the spread between pixel values in an image. It measures how far the pixel varies from the mean value.

$$\sigma^2 = \sum_{i=1}^{n} (\text{Xi} - \mu)2 \qquad (3)$$

Xi: individual data point

μ: mean of data points

N: no.of points

Standard Deviation

Standard deviation is used to calculate the amount of variation of a set of data values.

$$\sigma = \sqrt{\sum_{i=1}^{n} \text{pi}(\text{xi} - \mu)2} \qquad (4)$$

Correlation

Nearby pixels of eges in an image are highly correlated which helps in identifying the similar regions.

$$\text{Correlation}=\sum_{i,j}\frac{(i=\mu_j)(j=\mu_j)p(i,j)}{\sigma_i\sigma_j} \quad (5)$$

Skewness

This parameter indicates the lack of symmetry in distribution of pixels.

$$\text{Skewness} = \sum_{i=1}^{N}\frac{(Ii(x,y)-m_k)^3}{(N-1)\sigma^3} \quad (6)$$

SNR

Signal to noise ratio is defined as the ratio of signal power to the noise power, and it can be expressed in terms of decibels.

$$\text{S/N}=\frac{\text{Signal power}}{noise\ power} \quad (7)$$

PSNR

PSNR can be calculated by taking square of the peak value in the image and divide it by the mean square error.

$$PSNR = \frac{\max(s^2(n))}{\text{MSE}} \quad (8)$$

S(n) - Signal to noise ratio

MSE

Mean Squared Error (MSE) measures the average of squares of error or deviation in an image .

$$\text{MSE} = 1/n\ \sum_{i=1}^{n}(\text{Yi}' - \text{Yi})^2 \quad (9)$$

n - No.of pixels

Yi - Original value

Yi` - Deviated value

Relative smoothness

Relative smoothness is used to measure the grey level contrast of image

$$R=1-\frac{1}{1+\sigma^2} \quad (10)$$

Where, σ represents standard deviation of the image.

Energy

Ability to visualize and classification can be improved by energy vector calculation.

$$E=\sum_x\sum_y I(x,y)^2 \quad (11)$$

Where, I denotes the intensity of pixel value at x,y.

Contrast

Contrast features extracted are used in classification to identify iris properly.

$$C = \sum_x \sum_y (x-y)^2 I(x,y) \quad (12)$$

Entropy

The statistical evalution of randomness which characterizes the texture feature in an image is said to be entropy

$$E_n = -\sum_x \sum_y p(x,y) log[p(x,y)] \quad (13)$$

Where p is the probabilty of occurrence of a particular pixel value.

Homogenity

Closeness of the distribution in pixel elements of an image is computed using homogeneity.

$$H = -\sum_x \sum_y \frac{p(x,y)}{1+(x-y)^2} \quad (14)$$

Kurtiosis

Kuriosis defines the sharpness of peak frequancy distribution curve.

$$K = \sum_{i=1}^{N} \frac{(Ii(x-y)-mk)^4}{(N-1)\sigma^4} \quad (15)$$

Where I(x-y)represent intensity of image, N represents the number of sample lines,σrepresents standard deviation and mk represents the mean of sub-bands.

3.4 MATCHING

In the matching phase, the input image features are compared with already extracted features in the database. If both features match, the person will be authorized or else unauthorized. This is indicated with the help of a dialog box.

3.5 PARTICLE FILTER

Smallest number of particle are used to cover an object and moniter the object movements like walk.first the particle are trace the target object and perfom some following operation

1) particle generation

2) Weight Normalization

3) Weight computation

4) Estimation Computation

Particle generation

Here generate the particle in each frame of the camera detect object. In this generation stage each particle having some weight to evaluate the tracing object.

S - Denotes as sequence number of frame present in the cctv or object datasets.

W – Denotes the weight of each particle

T – Denotes amount of time taken for frame object and particle evaluation time

Total weight estimate the each particle = S^,W^(-1)

Weight Normalization

The weight normalization denotes the number of particle and the actual weight of the frame will be calculated.

$$W_{t=}^{i} W_{t}^{i}/n \quad (16)$$

I = Denote the frame object weight particle

N = Denotes the Maximum number of particle using .

Weight computation

Weight computation

Each particle weight denotes total weight of each frame and number of particle – actual weight of particle.

$$\text{Total weight t} = \text{SUM}\{W_{t}^{i}\}_{i=1}^{N} \quad (17)$$

In the particle Resampling mean the total weight is not exceeding the threshold value, if the value is goes to exceed state particle failure will occur

Estimation Computation

Estimation computation calculation means Sample and it's the largest weight i=0……,N so in this state we have calculate the N largest value of the particle.

4. RESULT AND DISCUSSION

DATABASE

Initially input image is obtained from CASIA Iris V4 database.All the Iris images are in the form of 8 bit bitmap image format. This input image is in gray scale form.

INPUT IMAGE

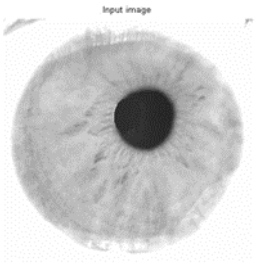

Fig 4.1: Input Gray Image

Input image is in grayscale , these datas are used for the purpose of training and testing. A sample input image is shown above in fig.6.1

HISTOGRAM EQUALIZATION

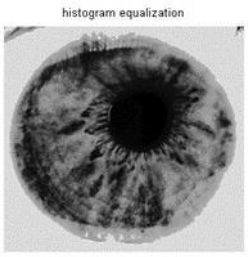

Fig 4.2: Histogram equalization

The next step in Iris recognition is histogram equalization. In Histogram equalization, the contrast of the image can be increased by adjusting the image intensities. Let X be the image and it can be represented by a mr by mc matrix and it ranging from 0 to L-1 . L denotes no. of possible intensity values. It is often 256. The histogram equalized output is shown above.

ORGINAL GRAY IMAGE

Original gray image can be obtained by classifying each pixel in an image into either of two membership function white or black. This is the first output of Fuzzy interference logic.

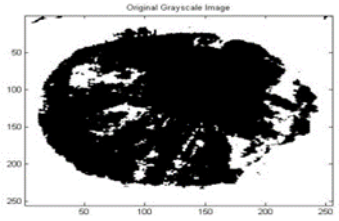

Fig 4.3: Original Gray image

EDGE DETECTED USING FUZZY INTERFERENCE LOGIC

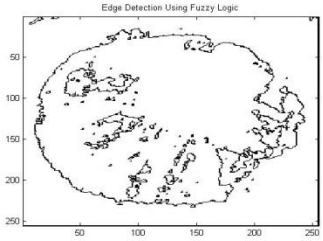

Fig 4.4: Edge detected using Fuzzy Interference Logic

Fig 6.4 Shows the output ofobtained by applying FIS . The Output of FIS, Shows the edge of the iris image and this edgeFigure above shows the edge of an iris image which is obtained by using fuzzy interference logic

FEATURE EXTRACTION

Features =

- Contrast = 1.2159
- Correlation = 0.4516
- Energy = 0.7913
- Homogenity = 0.9392

- Mean = 0.6671
- Standard deviation = 0.1258
- Entropy = 0.3899
- Variance = 0.0148
- Smoothness = 1.0000
- Kurtosis = 11.1480
- Skewness =-3.1856

MATCHING

In matching phase, the features of test images are matched with already extracted features present in the database. If both the features matches, it will be indicated by using the dialog box iris recognized as shown below

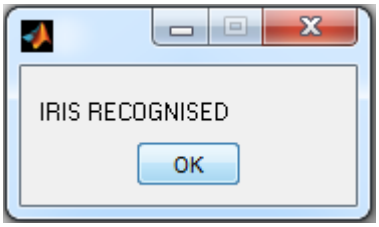

Fig 4.5: Iris recognized

PARTICLE FILTER

After the iris of the person got recognized the person will be allowed to enter into the room. While the person walks the particle covers the person and these particles are used to identify the location of the user

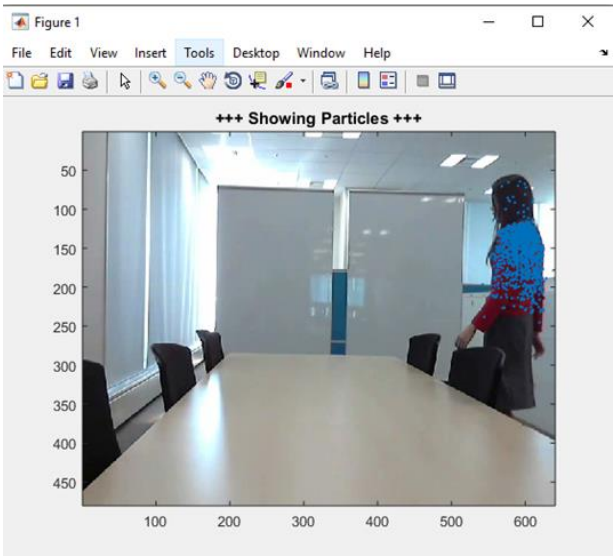

Fig.4.6 Person with Particle

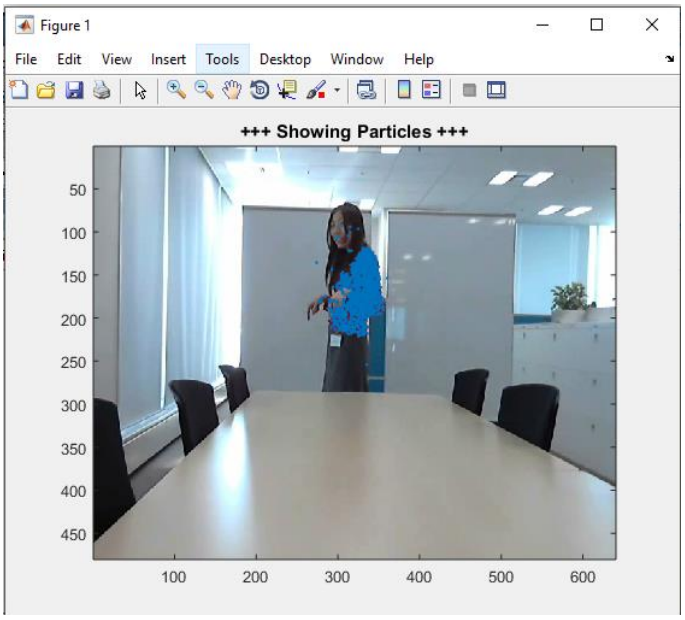

Fig.4.7 Person covered with particle

The above image shows that the particle covers the person while walking along the pathway. These particles are used to identify the exact location of the person. The movement of the person is traced by using these particles and are used to find out the behaviour of the person.

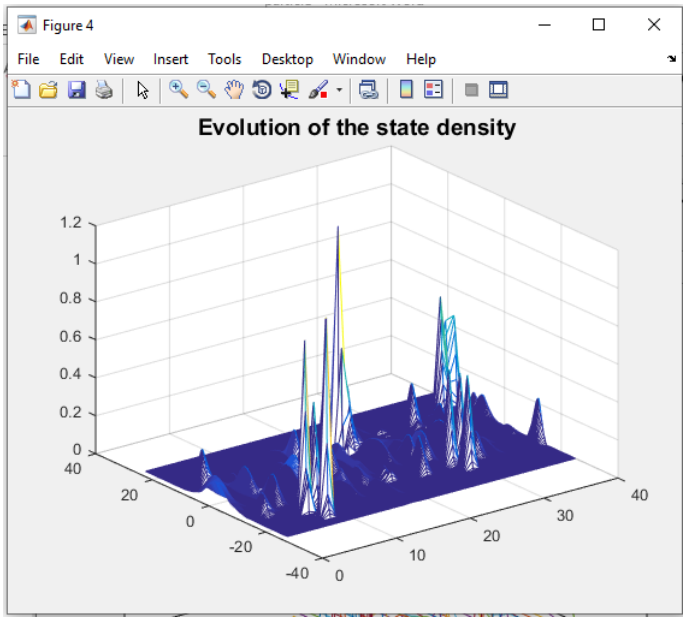

Fig4.8.Evolution of state density

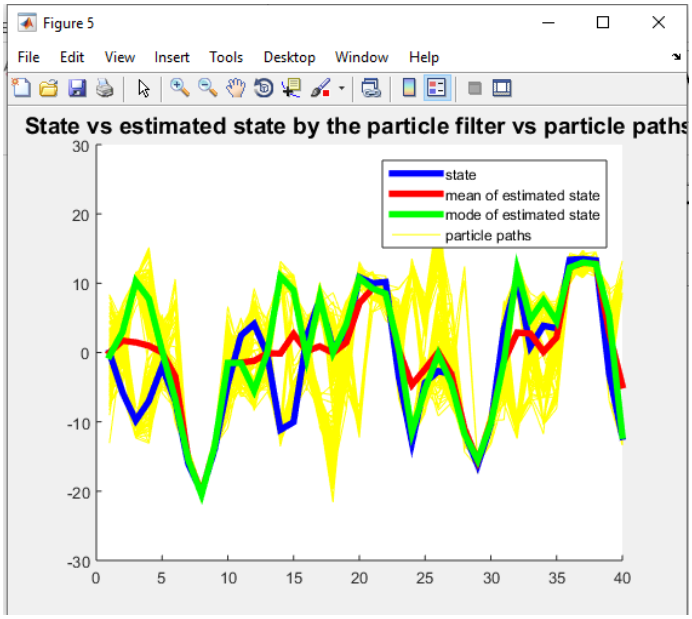

Fig 4.9 state vs estimated state by particle filter vs particle path

Fig 4.9 shows the graph that estimates current state and estimates state of the particle and its path.

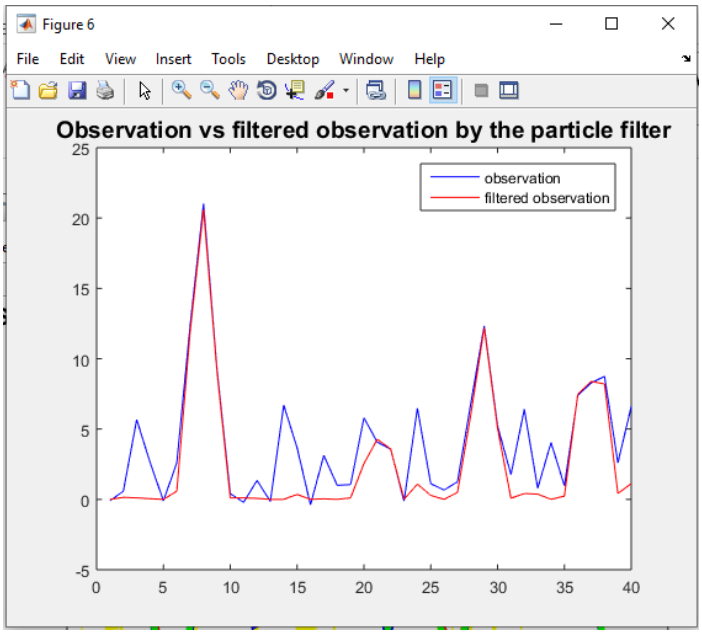

Fig. 4.10 Observed vs Filtered observation by the particle filter

Figure shows the observed output vs filtered out put of the particle and its path. These are used to find the exact location of the user. As the location of the user is very important to provide the necessary service to the user. Based on the location found the user will be provide heat, ventilation and air condiion

5.CONCLUSION

Recognition of human using Iris recognition system is the automated method of identifying or authorizing the individual before entering into the smart city. Human iris is stable and remains unchanged throughout human life. The proposed method employs Fuzzy interference logic algorithm to detect the edges present in an image. It detects almost all the edges in an image. Segmentation plays an important role in detection of a person, a rule-based algorithm known as fuzzy interference logic is

used to detect the edges present in the image efficiently. Features are extracted and compared with the features of test image. This method shows improved accuracy. This method can be improved by adding additional features so that the accuracy of the image can be improved further. After the recognition of the person, only the recognized persons are allowed to enter into the smart city. In smart city the individual will be provided with smart services based upon the requirement of the user. Due to smart services the power consumption and cost get reduced. This method can be implanted in Border crossings, schools, colleges, banks etc in order to avoid unauthorized access.

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