# Face Detection Using MATLAB And Interfaced with Arduino

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*Abstract :*  This paper explains face detection And recognition using matlab interfaced with Arduino. Aim of this paper is to recognize this paper and find the similar once for security purposes which is necessary nowadays. In this paper the real time face detection and recognition is implemented with input and output devices such as web cam and Arduino board and microcontroller. The methode to detect similar faces using parameters of image and recognization of the detected image are shown in this paper.

## I. INTRODUCTION

The Demand for video and Audio surveillance is drastically increasing day by day anyway it is always a challenging task to give an efficient and faster detection of face and tracking algorithm always. In this paper we sured an efficient faster face detection methods, we used Matlab because of it's major advantage of having built-in functions for image processing and easier to interface objects and boards like camera Arduino RASPBERRY PIE and also due to it's high compatibility and accuracy Image processing algorithms. The aim of the paper to detect similar faces and by using web cam. So we go by this
Steps
1. To detect the face. For this we use new form of image representation called integral image which extract futures from image easily and at faster rate.
2. Selection of features of the face.
3. To recognize the similar features from the selected face.The vertical and horizontal axis of detected image is given to Arduino board such that the detected object is in the range of camera. Use Arduino because it is open source of the browser electronics of hardware and software Components and also it can be programmed in different ways. The Arduino software can be programmed by Matlab using special functions.

## II. RELATED WORK

Viola and Michael Jones proposed method for objects detection using haar features in this paper Variou methods of object detection according to accuracies viola Jones , Rowley-Baluja-kanade , Roth-Yang-Ahuja , Schneiderman-kanade. The features of a face in an image a calculated first and then these Features are Cascaded to form a strong classifier. These features are then used to identify the object. Chathranth and Gupta et.al proposed a method of detecting the features of the face in an image. A set of Detailed experiments on difficult face detection and tracking data set are conducted. This Data set includes faces under a wide range of conditions such as illumination, pose , scale and variations of camera. Divyageorge and aiunkant proposed a method for Face detection and tracking in a video using Optical Flow techniques. The tracking is implemented Using different methods of Optical Flow such as Block Based methods , discrete  optimization method, Differential methods. In the work pyramidal Lucas-kanade feature tracker optical Flow method is Used for tracking the face. Zhu Liu and Yao want Proposed algorithm Based on templates Matching based on Dynamic Programming For Face face detection and tracking. Preliminary Experimental Results says that the face detection algorithm is fast As well as reliable and the Face tracking and clustering method are promising.

## III. PROPOSED ALGORITHM

In this the face detection and tracking are implemented by Matlab and Arduino which Starts with Initializing That position of camera which gives the video as input to matlab. The Matlab detects the face in the video given by web cam and sends data to Arduino. The Arduino tracks the face by moving servo motots. The web cam is attached to servo motors. The flow chart is shows below

$$nn(p,q) = \sum_{p'<=p, q'<=q} n(p', q')$$
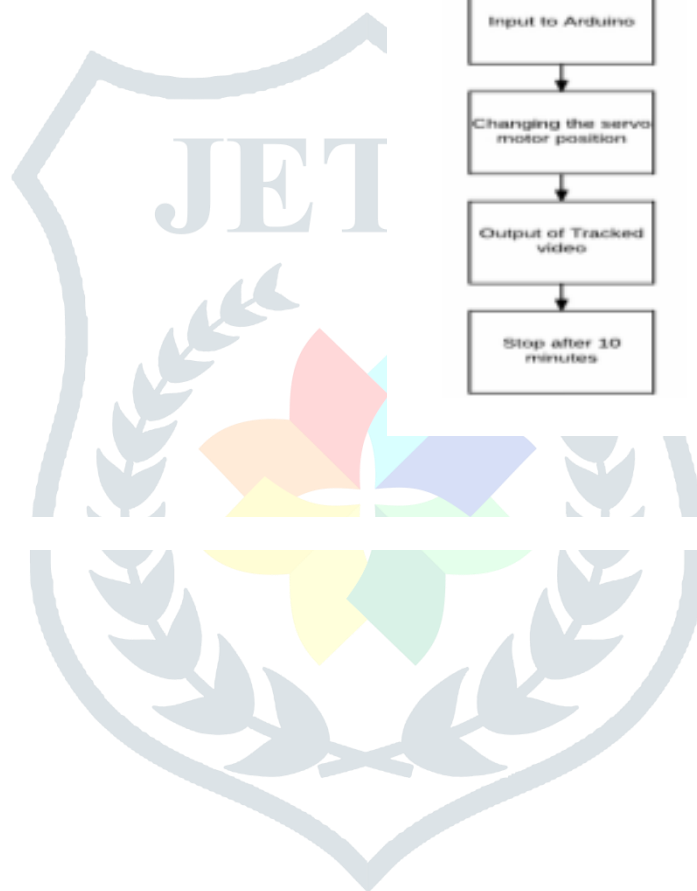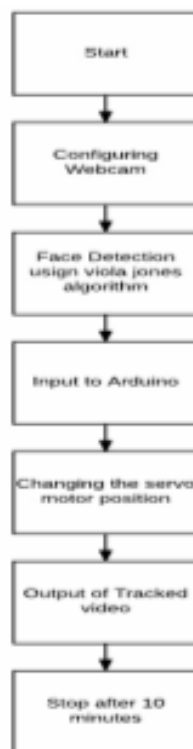


## IV. METHODOLOGY

A. Haar features

In this any image is classified into two types namely Pixel based system and feature based system since the feature based system is easy to operate and much faster then Pixel based system we use feature based system. Generally for face detection procedure using feature based system there are the types of feature i.e., 2 rectangle , 3 rectangle , 4 rectangle features generally the features are calculated as difference of sum of pixels in white portions to the sum of pixels in black portions. The 4 Rectangle Feature Computes the difference between Sun of diagonal pairs. Similarly 3 rectangle feature Computes the difference between sun of adjust of the rectangle to the middle one. 2 rectangle feature shows the difference between the Pixels within 2 rectangular region which are of same shape and size and placed Horizontally and vertically Adjacent to each other.
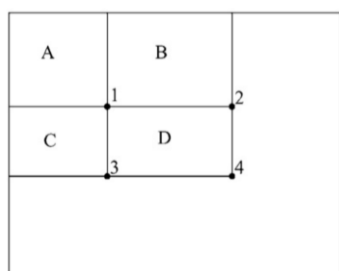
Fig. 3.  integral image

$$c_{\mathrm{j}}(x) = \begin{cases} 1, & \text{if } p_j f_j < p_j \varphi_j \\ 0, & \text{otherwise} \end{cases}$$
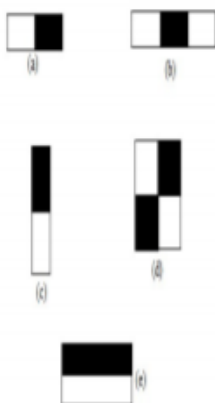


Fig. 2.  Haar Features

### B. INTEGRAL IMAGE FORMATION

Rectangular features of an image are best described by its intermediate form which we call it as an integral image. The formula for calculating the integral form of an image is given by,

This can be explained by taking the below image

In the above diagram, point 1 describes the total sum of pixels that are present in region A. For point 2, gives the sum of pixels of the regions A and B. Similarly for points 3 and 4 sum of pixels in the region (A, C) and (A, B, C, D). Where nn(p,q) is an integral image and n(p',q') is the original image. Using the following formula,

$m(p, q) = m(p, q - 1) + n(p, q)$    . …………(2)

$nn(p, q) = nn(p - 1, q) + m(p, q)$…………. (3)

Where m(p,q) is the cumulative row sum

m(p,-1) = 0 and nn(-1,q)=0

### C. AdaBoost

Adaboost the name itself has the word support in it which intends to push or it causes something to increment. AdaBoost builds the execution of a powerless calculation. It is utilized to train the classifiers and to selece a little arrangement of highlights from countless. The property of boosting the execution of proposed calculation is principle motivation to use in the proposed calculation. By taking the highlights of the picture utilizing two rectangular, three rectangular and four rectangular Haar includes on a sub window around 160,000 highlights can be discovered which is extremely vast number contrasted with the size of the picture. The procedure for figuring these many number of highlights is peaceful costly. Out of 160,000 highlights little number of highlights can be chosen and joined to make a productive classifier. Adaboost builds up the classifier that self learns and adjusts the edge an incentive for choosing the highlights from the general highlights to construct a solid classifier. Let cj(x), fj,phij and pj means the classifier,feature,threshold furthermore, equality individually demonstrating the heading of disparity where x is a 24x24 pixel sub-window of a picture.The underlying classifiers which has less unpredictability has a mistake rate of 0.1 to 0.3 while, the classifiers that are intricate has a blunder rate of 0.4 to 0.5. AdaBoost produces and calls the Classifier in each round from t=0, 1,, T. For each estimation of t, there will be dispersion loads wt is refreshed that portrays the significance of picture in the informational collection for arrangement. On each round the heaviness of erroneous arranged picture is expanded what's more, weight of the accurately arranged picture will be diminished with the goal that the new classifier centers around the mistakenly arranged picture. The system for boosting is appeared as follows,

• Given model pictures (x1, y1) . (xn, yn) where yi = 0 for negative and yi = 1 for positive models.

• Initialize loads w1,i=1/2u,1/2v for yi= 0,1 individually where u and v are the quantity of negatives and positive individually.

• For t=1, ., T:

1. Normalize the loads, so that wt is a likelihood dissemination.

2. For each element, j, train a classifier tj which is limited to utilizing a solitary component. The blunder is assessed with appreciation to wt.

3. Choose the classifier, tt, with the most reduced mistake

4.Update the loads:

Where will = 0 if example xi is classified correctly , ei = 1 otherwise , and formula

• The final strong classified is:

$$w_{t+1} = w_{t,i}\beta t^{1-ei}$$

$$c(x) = \begin{cases} 1, & \text{if } \sum_{t=1}^{T} \alpha_t c_t(x) >= (1/2) \sum_{t=1}^{T} \alpha_t \\ 0, & \text{otherwise} \end{cases}$$

## D. CASCADING

Basic classifiers are the classifiers which isolates the positive and negative piece of an image.These are additionally known as frail classifiers. The classifier which has some extra highlights like taking the yield from the past easier classifier and given as information i.e., it might either dismiss the window or pass it on is called perplexing or solid classifiers. In request to get the exact location this procedure continue going to accomplish the precise yield. To get distinguished yield the sub band need to pass all the middle of the road classifiers generally the sub band window is dismissed in the way. This general structure of recognition is that of a savage choice tree is known as course. Stages in the course utilizing preparing classifiers are developed by AdaBoost. Default AdaBoost limits esteem is intended to get least false negatives and to yield low blunder rates. Be that as it may, a lower limit yields higher location just as higher false positive rates. In classifiers precision diminishes on the off chance that we decrease the calculation time. Consequently there is a exchange off among precision and speed. To defeat this one another classifier is built from the two component solid classifier known as first stage classifier. In this we can recognize 100 percent of the appearances with a bogus positive rate of 40 percent by altering the edge. The second classifier experiences increasingly troublesome assignment then the first. The total thought is to wipe out the undesirable regions and to expand the likelihood of face recognition in the underlying stages at exactly that point there will be more increment in the likelihood in further stages. The falling is appeared in the figure(4).
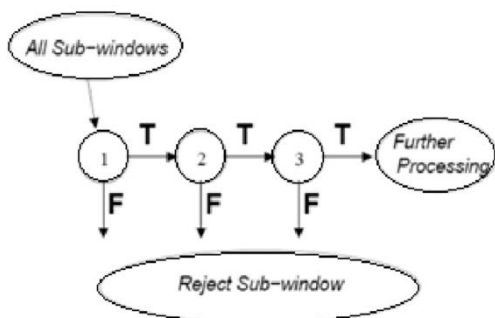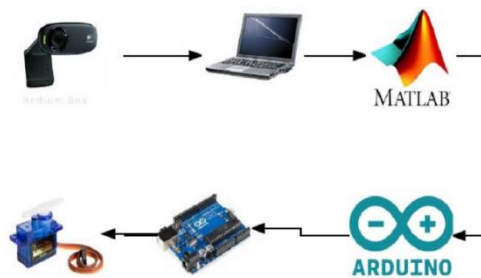
**E. Following of face**



Fig. 4. cascading



Fig. 5. Tracking of Face

At first, the camera position is set to the default state i.e., at zero degrees by arranging the servo engine position. At that pointthe video input is given to the MATLAB for face recognition in light of viola jones calculation. identifies a face from each casing of the live video stream and embeds a bouncing box face. Presently, the centroid of the jumping box is determined. The co-ordinates of the centroid are sent to the Arduino Micro controller as a string through the sequential link associated with the PC and Arduino Micro controller. The Arduino small scale controller gets the situation of container and tilt servo engines. The dish servo engine is utilized for the following the face on a level plane while the tilt servo engine is utilized for following the face vertically. Presently, the casing is partitioned into 4 parcels i.e., right, left, best and base parts separately. The Arduino smaller scale controller checks the situation of centroid comes in right half or left 50% of edge. In the event that the centroid falls into the correct half at that point the camera is panned to left and in the event that it falls into the left half of the edge then the camera is panned to right. In like manner, the camera is tilted utilizing the base and best parts of the edge. At long last, the camera is moved so that dependably

the focus of the casing agrees with the centroid.
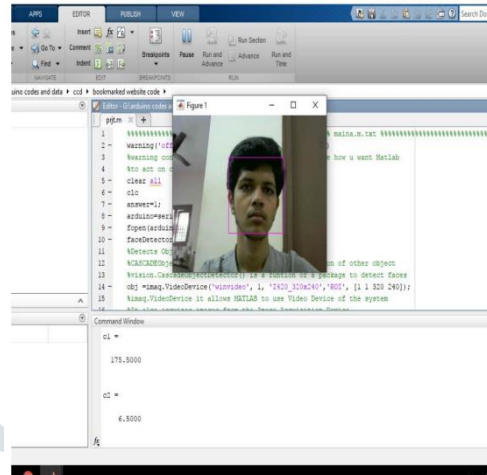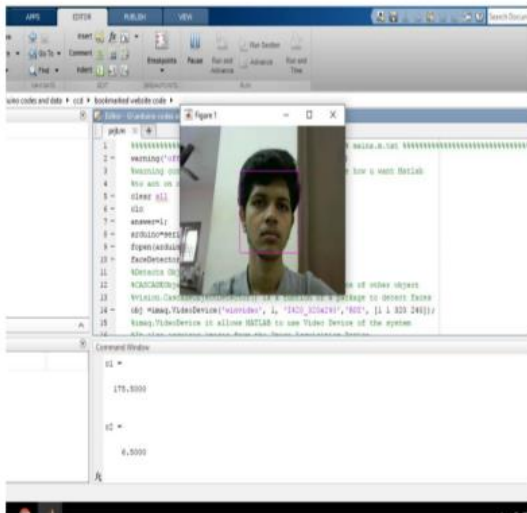
## V. SIMULATION AND RESULT



Fig. 7. Tracking of Face

**The Figures 6,7 shows thedetection and tracking of theface using MATLAB and Arduino**



Fig. 8. Hardware Setup

Figure 8 demonstrates the setup for the execution of the face identification and following utilizing MATLAB and Arduino.

## 6. CONCLUSION

our work, the following framework is actualized dependent on the facial identification [4]. The face recognition calculation is fabricated utilizing a MATLAB program and interfacing with a camera utilizing an exceptional direction, that read the video from the camera what's more, the outcome is sent through the Arduino microcontroller for following the development of the face. The calculation utilized here is Viola Jones calculation which is more effective than others, this calculation distinguishes faces all the more proficiently and furthermore at a quicker rate as appeared in the outcomes. Here we previously recognized the picture utilizing the calculation and afterward sent the directions of the face to the Arduino microcontroller, here we customized the Arduino controller so that if the directions of the face are moving endlessly of a specific range then the controller sends control signs to make the face directions to be in the given extend. The Viola Jones calculation utilized here is adaptable and can be balanced by the conditions.

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