

# Face Detection and tracking using Image processing on Raspberry Pi

## Frame per second analysis for motor control

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**Abstract—** Image processing is nowadays used as a piece of various applications. Confront area and its following is one of the basic frameworks used as a piece of the uses of image processing. in this paper we have shown an application for the improvement of the auto applications with the help of face revelation. The paper shows the examination how the assurance of the camera impacts the edge each seconds and respectably the perfect open door for stand up to acknowledgment. The image processing using OpenCV for face detection, face tracking and its recognition for automotive application is done here. We have used processor controller and common usb camera for controlling the electrical motor which in this way controls the motorized auto application. the viola-jones estimation for stand up to acknowledgment using adaboost library in this way structure relies upon adaboost computation and changed works faces haar-like highlights [5] in the item part we have used python vernacular with opencv reinforce for the face distinguishing proof using haar course records gave by intel open source. we have shown the results on layout consistently impact on stand up to distinguishing proof.

**Keywords—** Image Processing, Face detection, Face tracking, Haar cascade, raspberry pi, frame per second

### I. INTRODUCTION

Image Processing is a methodology to overhaul unrefined images got from cameras or sensor put on satellites, space tests and flying machines or pictures taken in conventional regular day to day existence for various applications. This field of image processing in a general sense improved starting late and connected with various fields of science and development. The image processing generally oversees image securing, Image overhaul, image division, incorporate extraction, image portrayal et cetera. The basic task of face acknowledgment is to recognize whether there is a certain face in a given image or image progression, while that of face territory is to discover the face unpretentious components including the position, size, sum and spatial dispersal. Nevertheless, it is endeavoring to recognize a face from an image with complex establishment in light of the moving traits

in appearances, for instance, scales, positions, presentations, and positions, and different outward appearances and light conditions.

Advanced image processing is dependably an intriguing field as it gives enhanced pictorial data for human translation and processing of image information for capacity, transmission, and portrayal for machine recognition. Image Processing is a system to upgrade crude images got from cameras or sensor put on satellites, space tests and air ships or pictures taken in ordinary everyday life for different applications. This field of image processing fundamentally enhanced as of late and stretched out to different fields of science and innovation. The image processing for the most part manages image procurement, Image improvement, image division, include extraction, image grouping and so forth. Various continuous face following structures have been delivered in this paper. These procedures enhance quality, expels clamor, adaptable in nature, and jelly unique information exactness of the image.

The essential errand of face detection is to distinguish whether there is a sure face in a given image or image grouping, while that of face area is to figure the face subtle elements including the position, size, amount and spatial circulation. Be that as it may, it is trying to distinguish a face from an image with complex foundation as a result of the shifting attributes in countenances, for example, scales, positions, introductions, and stances, and in addition diverse outward appearances and light conditions.

The Viola-Jones calculation utilizes purported course classifiers. A course classifier is developed as a succession of stages. At each stage a rundown of channels are connected to the region inside the sliding sub-window. A case of such a multistage channel with 25 phases is done Each time the sliding sub-window shifts (normally pixel by pixel, however it can be more pixels at an opportunity to additionally speed things up), the new area inside the sliding sub-window is prepared through the course classifier arrange by-organize. At each stage, the rectangle highlight is assessed and the frail classifier is registered. At that point, a limit check is utilized to

check whether the locale is dismissed as a face hopeful or on the off chance that it needs to keep on being prepared in the following stage. To have the capacity to recognize countenances of various sizes, the calculation works with a pyramid of scaled images. This permits clearing utilizing a similar arrangement of Haar-like examples diverse scaled renditions of the underlying image. Along these lines, sliding sub-windows will clear every one of the images from the pyramid. At the point when the external most for circle in the pseudocode portrayal from completes its execution, the Viola-Jones calculation would have found and set apart with rectangle markers all faces show in the first test image and in the scaled forms of the image[1].

We need to answer the accompanying inquiries: what is the most ideal route for the tenant identification and the face recognition central terms in PCs, the best setup for the exhibit to get the vast majority of image processing? How might we upgrade the estimation of shared work amid a period restricted functional work session? In segment II we introduce our writing audit for the past work done on the image processing for the face location and following. In segment III we display a procedure system on the image processing and the best techniques for the face location with the end goal of the tenant identification. In segment IV, we demonstrate the Raspberry Pi introduced with opencv with python ties for confront identification and the outcomes we got in the research facility.

## II. LITERATURE REVIEW

The DCT removes features from go up against images in perspective of skin shading. Feature vectors are worked by figuring DCT coefficients. A self-dealing with direct (SOM) using an unsupervised learning system is used to arrange DCT-based segment vectors into social occasions to perceive if the subject in the information image is "accessible" or "not present" in the image database[1]. RSC figuring addresses a data image as a straight blend of the planning images, all images used as a piece of this approach should be of practically identical size, especially balanced, and totally frontal. It is required to modify the face images prior using RSC on certifiable images [2]. The third responsibility is a technique for solidifying continuously more unusual classifiers in a "course" which grants establishment regions of the image to be instantly discarded while spending more computation on promising article like districts. The course can be viewed as a challenge specific point of convergence of thought framework which not under any condition like past philosophies gives genuine guarantees that discarded regions are most likely not going to contain the subject of interest [3]. The Dark and Low separation images discovered by using the Raspberry Pi camera module are updated remembering the true objective to recognize the particular region of image [7]. The procedure for consistent human face area and following using a balanced interpretation of the computation suggested by Paul viola and Michael Jones [8]. Robot course, remedial image examination, photo organization and some more. From a PC vision point of view, the image is a scene containing

objects of interest and an establishment addressed by everything else in the image. The relations and relationship among these articles are the key factors for scene understanding. Question revelation and affirmation are two fundamental PC vision assignments [9].S.V.Tathe et al. proposed for human face identification and acknowledgment in recordings. Endeavors are made to limit handling time for discovery and acknowledgment forms. To decrease human mediation and increment general framework effectiveness the framework is isolated into three phases movement identification, confront recognition what's more, acknowledgment. Movement identification decreases the pursuit region and preparing multifaceted nature of frameworks [10].

## III. PROCESS METHODOLOGY

Raspberry Pi: The Raspberry Pi is a crucial embedded structure and being a facilitate a singleboard PC used to reduce the multifaceted idea of systems constantly applications.[7] as appeared in the fig 3.1.1 for image processing

SoC: Broadcom BCM2837 CPU: 4× ARM Cortex-A53, 1.2GHz GPU: Broadcom Video Core IV RAM: 1GB LPDDR2 (900 MHz) Networking: 10/100 Ethernet. Raspberry Pi 3B show is used as the essential processor in the lab break down. Commonplace USB 5.1V and 1000mA supply is required to control up the raspberry pi.

Arduino: Microcontroller ATmega328P Operating Voltage 5V Input Voltage (recommended) 7-12V Input Voltage (control) 6-20V Digital input/output Pins-14 (of which 6 give PWM yield) PWM Digital INPUT/OUTPUT Pins 6 Analog Input Pins 6 DC Current for each input and output Pin 20 mA DC Current for 3.3V Pin 50 mA Flash Memory 32 KB (ATmega328P) of which 0.5 KB used by bootloader SRAM 2 KB (ATmega328P) EEPROM 1 KB (ATmega328P) Clock Speed 16 MHz LED\_BUILTIN 13 Length 68.6 mm Width 53.4 mm Weight 25 g.

Motor: A servo motor is an electrical motor used for initiation of the application. For instance, motorized control sparkle box and automated opening or closing of gateway. Weight: 9 g, Dimension: 22.2 x 11.8 x 31 mm approx., Stall torque: 1.8 kgf-cm, Operating pace: 0.1 s/60 degree, Operating voltage: 4.8 V (~5V), Dead band width: 10 μs, Temperature go: 0 °C – 55 °C

USB Webcam: Specification of the camera are as presentation: Auto or manual, Angle of View: 58 degree, Interface: USB2.0, Frame Rate: 30 fps (MAX) Lens f=6.0 F=2.0, Focus Range 4cm to unendingness: (32-bit or 64-bit) USB 1.1 port (2.0 endorsed) DIMENSIONS: 5.8 x 7.8 x 5.5 cm

Software Requirement

1) Operating system:

The raspberry pi is uploaded with debian based raspbian OS. The raspbian OS will have pre-installed Python 2.7 and Python 3 IDE for programming applications.

2) Programming Language:

### A. Abbreviations and Acronyms

OpenCV- Open Computer Vision

IDE – Integrated development Environment

I/O – input/output

### B. Experimental Setup

The exploratory setup for the opening and shutting of the compartment enclose the car application utilizing image processing is done as takes after. As the camera will consistently catch the video then raspberry pi forms the image and contrasts it and the fell xml record the component, for example, nose, mouth, temple orders it as a face. The face recognition will have its co-ordinates then controller (for this situation arduino) judges what edge is required for the motor to pivot. Controller sends flag to the motor which thus influences the compartment to box to open or close. The yield of the main stage is utilized for extricating facial highlights like eyes, nose, and mouth utilizing AAM (Active Appearance Model) strategy[4].

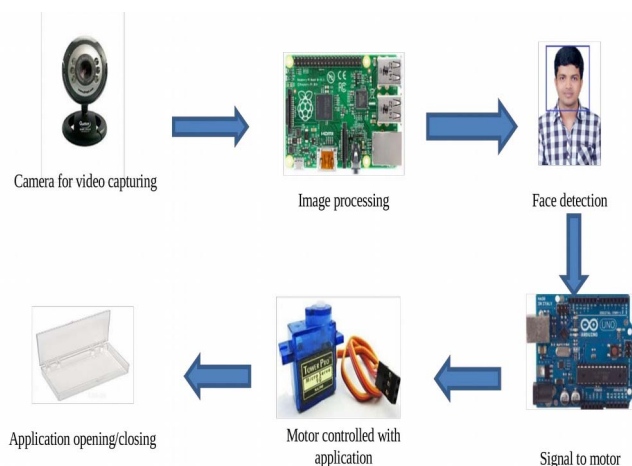


Fig.3.1.1 Experimental lab setup

The above setup demonstrates the test lab setup done in the lab for the task. It is utilized for the face recognition and development of the motors with the assistance of the face identification. Henceforth to acquire ideal speed it needed speedier edge every second. The issues in the perceiving the human face if there is an adjustment in the facial image like, lighting conditions, complex foundation, stance and impediment [6].

The fig.3.1.2 gives the outcomes and images acquired in the lab for the assurance of face co-ordinates in pixel the rectangle which is drawn on the face gives the centroid in the pixel esteem.

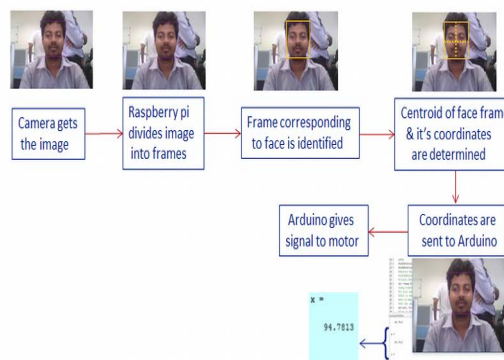


Fig.3.1.2 Results obtained in lab setup

### C. Methodology

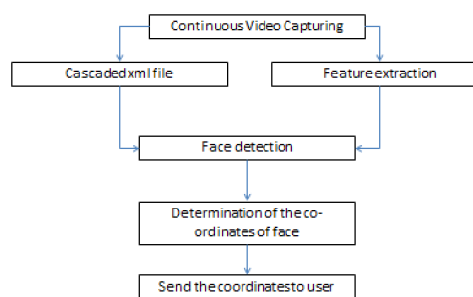


Fig.3.1.3 Flow chart for face detection

Face location is finished by image processing with python and OpenCV library. The above fig 3.1.3 clarifies that the camera will persistently catch the video. This video is handled by the processor (for this situation raspberry pi). In the processor the prepared haar course xml record is as of now put away then the processor tries to do the component extraction in the video, the real highlights in the face are eyes, nose mouth if the most extreme element matches it distinguishes it as a face. These co-ordinates of the face are then sent to the controller which thus controls the motor.

The primary worry for the face discovery is the speed with the raspberry pi. The two techniques for expanding the speed for confront recognition or the edge every second is by expanding the processing power or diminishing the determination. Subsequently we attempted to diminish the casing every seconds and the repeatability and reproducibility with a similar determination for similar readings.

### D. Equations

The examinations were done to expand the speed of the processor to send the co-ordinates of face to the controller in order to build the speed of the motor for ongoing applications. As the controller requirements for at any rate postponement of 62 nanosecond to execute a direction, in this way we expected to keep the Arduino code running at 50 milliseconds so as the motor should continue getting information. Hence to calculate frame per seconds we have used this formula

Let C = Counter of frames, every frame will increment counter by one (1)

$$T_1 = \text{start time counter in second} \quad (2)$$

$$T_2 = \text{End time in counter in sec} \quad (3)$$

Therefore counting frame per seconds will be equal to

$$\text{FPS} = C / (T_2 - T_1) \quad (4)$$

The counter will give us the number of frames and the denominator will give us the difference between the time in seconds

#### E. Experiment tabulated data

TABLE I. RESOLUTION VS FRAME PER SECOND

S.N	Resolution(width x height of window)	Frame per second	
		Before face detection	While face detection
1	1080 x 720	30	15
2	1080 x 720	30	15
3	1080 x 720	30	14
4	1080 x 720	30	18
5	1080 x 720	30	12
6	1080 x 720	30	16
7	1080 x 720	30	20
8	1080 x 720	30	15
9	1080 x 720	30	10
10	1080 x 720	30	15
Average Frame per second		30	15

The TABLE I show that the highest resolution i.e. 1080x720 of the camera the frame per second without having face detection the frame per second is 30 frames per seconds. But when the face is detected the frame per second is reduced drastically to 15 frames per second.

TABLE II. RESOLUTION VS FRAME PER SECOND

S.N	Resolution(width x height of window)	Frame per second	
		Before face detection	While face detection
1	720 x 360	30	16
2	720 x 360	30	17
3	720 x 360	30	18
4	720 x 360	30	19
5	720 x 360	30	20
6	720 x 360	30	21

S.N	Resolution(width x height of window)	Frame per second	
		Before face detection	While face detection
7	720 x 360	30	22
8	720 x 360	30	16
9	720 x 360	30	14
10	720 x 360	30	17
Average frame per second is		30	18

The above table shows that resolution i.e. 720x360 of the camera the frame per second without having face detection the frame per second is 30 frames per seconds. But when the face is detected the frame per second is reduced to 18 frames per second. This frame per second is increased from the previous resolution.

TABLE III. RESOLUTION VS FRAME PER SECOND

S.N	Resolution(width x height of window)	Frame per second	
		Before face detection	While face detection
1	320 x 240	30	24
2	320 x 240	30	25
3	320 x 240	30	26
4	320 x 240	30	24
5	320 x 240	30	25
6	320 x 240	30	26
7	320 x 240	30	26
8	320 x 240	30	24
9	320 x 240	30	25
10	320 x 240	30	26
Average frame per second is		30	25

The above table shows that resolution i.e. 360x240 of the camera the frame per second without having face detection the frame per second is 30 frames per seconds. But when the face is detected the frame per second is reduced to 25 frames per second. This frame per second is increased from the previous resolution. But further reducing frame per second will diminish its ability to detect the face.

#### IV. CONCLUSION

From the above experiments and the observation done in the lab where we have used viola-jones algorithm which uses cascaded xml file for the face detection. For having optimum speed for face detection on raspberry pi, we have found that the reduction in the camera resolution will increase the frame per second. As per our requirement for opening and closing of the glove box/ compartment box in the automotive application we have successfully applied this method.

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