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# *Face Tracking Robot*

## *J-Component*

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***Abstract—This paper discusses the development of robots , which can detect and track the human face. Face tracking uses Cascade Classification, Face Detection method is based on OpenCV library and Python . This robot hardware is based on the Arduino microcontroller with L293d Motor Driver and mobile camera . Face tracking shows good accuracy for human interaction. In order to show the effectiveness of the proposed method, we show the experimental results. Firstly, in the face detection, we show the face detection accuracy. Then, in the human tracking with mobile-robot by using face detection, we show the tracking performance.***

***Keywords—Python,FaceTracking,Face detection, arduino, L293d.(****key words****)***

## I. INTRODUCTION

Human face processing techniques for a video, including face detection, tracking, has attracted a lot of research interest because of its value in various applications, such as video structuring, indexing, retrieval, and summarization. The main reason for this is that the human face provides rich information for spotting the appearance of certain people of interest. Localizing faces and recognizing their identities are challenging problems: facial appearance varies largely because of intrinsic factors, such as aging, facial expressions, and make-up styles; and extrinsic factors such as pose changes, lighting conditions, and partial occlusion. These factors make it difficult to construct good face models. Many efforts have been made in the fields of computer vision and pattern recognition, but good results have been limited to restricted settings.

This paper describes state-of-the art techniques for face detection, tracking and use of robots with applications to real world problems. For each technique, we firstly describe the challenges they are to overcome. Then several modern approaches are presented. Finally, a discussion of these techniques is given.

## II. Theoretical Background - Face Detection

Face detection, which is the task of localizing faces in an input image, is a fundamental part of any face processing system. The extracted faces can then be used for initializing face tracking. An ideal face detector should possess the following characteristics:

### *A. Robustness:*

It should be capable of handling appearance variations in pose, size, illumination, occlusion, complex backgrounds, facial expressions, and resolution..

### *B. Simplicity:*

The training process should be simple. For example, the training time should be short, the number of parameters should be small, and training samples should be able to be collected cheaply

### C. Quickness:

It should be fast enough to perform real-time processing, which is an important factor in processing large video archives.

## III. Real-time face detection using cascaded classifiers

There are many approaches for building fast and robust face detectors. Among them, those using advanced learning methods, such as neural networks, support vector machines, and boosting, are the best. As shown in Figure 1, detecting the faces in an image typically takes the following steps:

-Window scanning: in order to detect faces at multiple locations and sizes, a fixed window size (e.g. 24 x 24 pixels) is used to extract image patterns at every location and scale. The number of patterns extracted from a 320 x 240 frame image is large, approximately 160,000, and only a small number of these patterns contain a face.

- Feature extraction: the features are extracted from the given image pattern. The most popular feature type is the Haar wavelet because it is very fast to compute using the integral image. Other feature types

include pixel intensity, local binary patterns, and edge orientation histogram .

- Classification: the extracted features are passed through a classifier that has been previously trained to classify the input pattern associated with these features as a face or a non-face.

-Merging overlapping detections: since the classifier is insensitive to small changes in translation and scale, there might be multiple detections around each face. In order to return a single final detection per face, it is necessary to combine the overlapping detections into a single detection. To this end, the set of detections is partitioned into disjoint subsets so that each subset consists of the nearby detections for a specific location and scale. The average of the corners of all detections in each subset is considered to be the corners of one face region that this set returns.

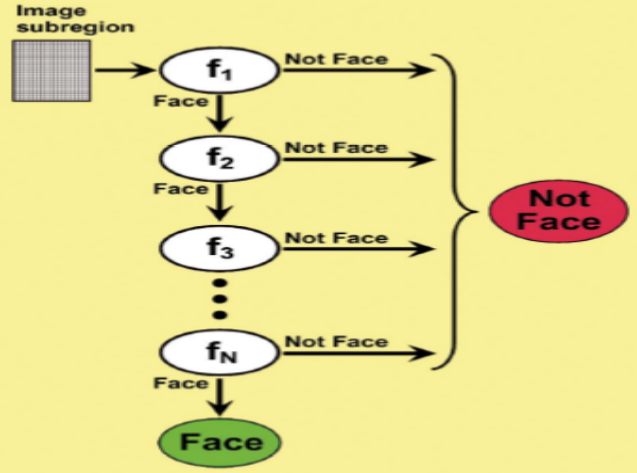


**Figure1:** A cascaded structure for fast face detection in which easy patterns are rejected by simple classifiers in earlier stages while more difficult patterns are processed by more complicated classifiers in later stages

Since the vast majority of processed patterns are non-face, the single classifier based systems, such as the neural network and support vector machines , are usually slow. To overcome this problem, a combination of simple-to-complex classifiers has been proposed and this has led to the first real-time robust face detector. In

this structure, fast and simple classifiers are used as filters in early stages of detection to quickly reject a large number of non-face patterns, whereas slower but more accurate classifiers are used in later stages for classifying face-like patterns. In this way, the complexity of classifiers can be adapted to correspond to the increasing difficulty of the input patterns.

## IV. FACE TRACKING

Face tracking is the process of locating a moving face or several of them over a period of time by using a camera, as illustrated in Figure 2. A given face is first initialized manually or by a face detector. The face tracker then analyzes the subsequent video frames and outputs the location of the initialized face within these frames by estimating the motion parameters of the moving face. This is different from face detection, the outcome of which is the position and scale of one single face in one single frame. Face tracking acquires information on multiple consecutive faces within consecutive video frames. More importantly, these faces have the same identity.

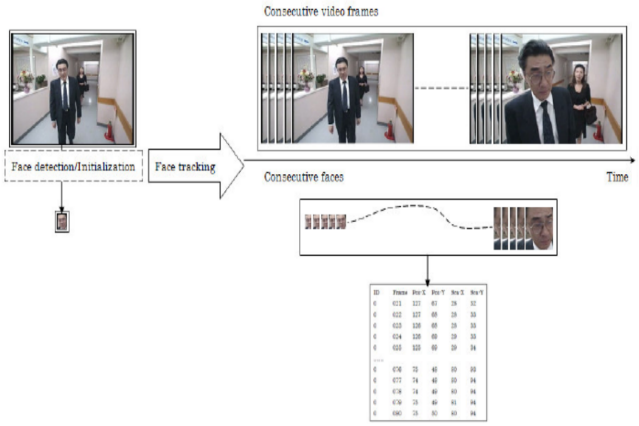


**Figure 2.** Overview of face tracking

## V. L293D BASED ARDUINO MOTOR SHIELD

The L293D motor driver shield includes two L293 motor driver ICs and a 74HC595 shift register IC. The shield has several important components.The L293D is a dual-channel H-bridge motor driver that

can control two DC motors or a stepper motor at one time. As there are two L293D ICs on the shield, it's technically capable of controlling a total of four DC motors.The 74HC595 is an 8-bit serial input and serial/parallel output shift register. It's used to extend four Arduino GPIO (or another microcontroller) to eight direction control pins for two of the L293D motor driver ICs. Figure 3 shows the proper connection between arduino and L293d motor driver.

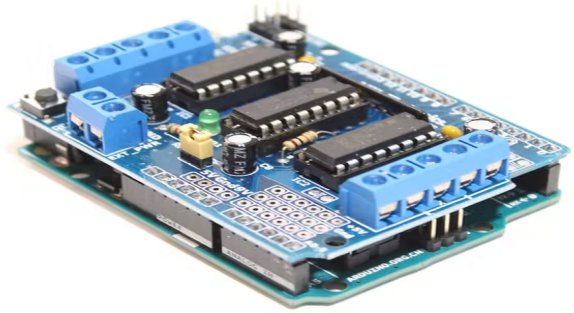

**Figure 3.** Connection between Arduino and L293D motor driver

## VI. METHODOLOGY

We use the mobile front camera to get the live feed , and then, It is analyzed and read using python and open cv to detect the human face and then create the square box fixed at the center of the main frame and then take the center of the box of the detected face. Now we calculate the deviation in the distance of the face from the center in the X and Y axis. Then this input is sent to Arduino through the serial port. IT process the input and then it is sent to the two servo motors and two DC motors using the L293d Motor driver. It functions or rotates according to the direction of our face.

## VII. Block Diagram

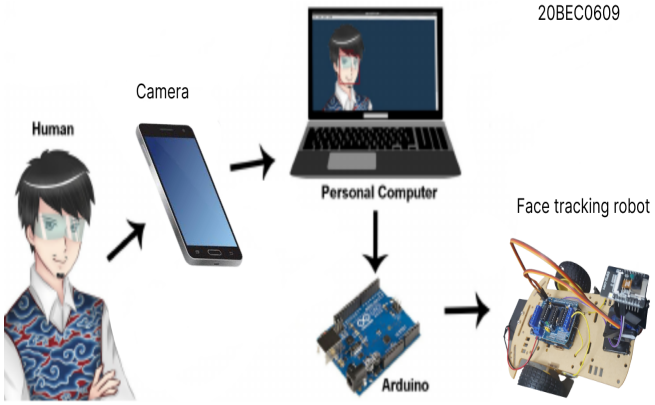


**Figure 4.** The basic process of the project

## VIII. Demo

the following figure 5, shows the face detection and tracking using python code and OpenCV files[cascaded classifiers - Face and eyes] and the red box is shown around the detected face and its center point is shown by the green dot and the fixed frame with the white box is shown as a reference frame for calculating the X and Y values.

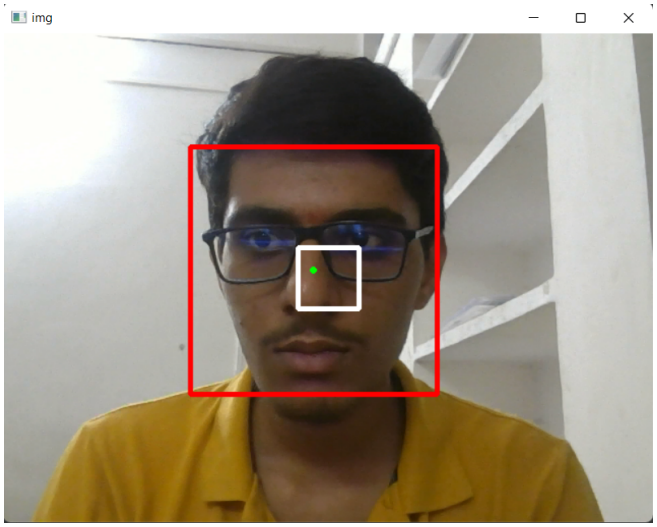


**Figure 5.** It is the Face detection and Tracking by python

The next part is the serial output. The following figure 6 shows the deviation of face in the distance or no of coordinates in the both X and Y Axis

```
X295Y286
X287Y224
X291Y215
X293Y209
X296Y206
X304Y197
X310Y190
X316Y189
X323Y188
X323Y187
X324Y184
X328Y182
X329Y184
X331Y187
X331Y188
X332Y189
X335Y194
X336Y196
X334Y197
```

**Figure 6.** Output of the serial port

Now the arduino processes the input from the serial monitor and sends it to the L293D motor driver. L293D reads and sends the signal to the servo motors and the Two DC motors. The arrangement is shown in the following figure 7.

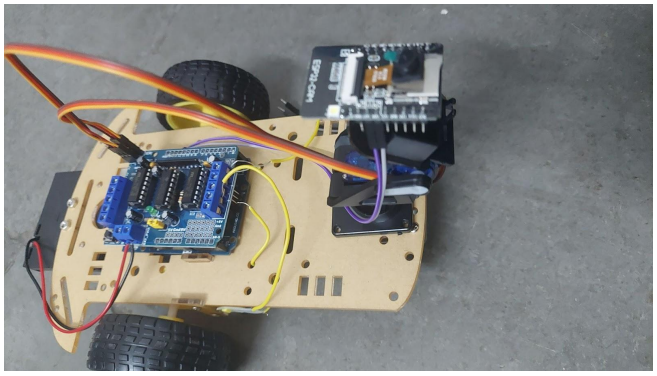

**Figure 7.** Arrangement of all the parts and the live demo

## IX. Reasult

The following project is working successfully and both the two codes {python and arduino} are working properly with no errors.
The theory , working , process and implementation of the project is understood properly.

## X. Conclusion

Robotics plays a significant role in the global economy and our everyday life. The market for robotics technology is rising in a wide variety of applications and human activities, particularly for the manufacturing, medical ,utility ,defense and consumer industries. This face tracking robot has good future importance because from now most of the products are based on the hand gesture and based on the human interactions with the technology. So this helps to keep track of the user so that we cannot miss any minute details or interactions given by the user. This can be used in the tv, pc and desktop computers and reduce the size of the robot such that it can be used anywhere to keep track of the persons.

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