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ML BASED FACE DISTANCE MEASUREMENT USING CAMERA FOR CHILDREN EYE SAFETY

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ABSTARCT

In a human and computer interaction-based system, distance estimation by computer vision between camera and human face is a vital operation. To calculate the distance between the camera and face, an estimation method based on feature detection is proposed in this project, where detection of eye and face in an image sequence is described. From the estimated iris and the distance between the centroid of the iris, an algorithm is proposed to determine the distance from camera to face. An architecture for face detection-based system on algorithm using Haar features and Canny and Hugo Transform for edge and circular iris estimation is presented here. From the estimated face, canny and Hugo transform is used to determine the iris, and to calculate the distance between the centroid of iris. Later Pythagoras and similarity of triangles are used for distance estimation and based on that, an Arduino controller is connected to the system/ laptop so that it will send the commands to the controller to turn ON and turn OFF of the TV for the safety of the children's eye. A buzzer and LEDs are connected to the controller so based on the distance they will turn on and off.

I.INTRODUCTION

Dynamic development in smart machine vision, robotics, vehicle guidance and other computer vision-based applications, distance measurement for computer vision is very important component of modem smart, dynamic and autonomous systems. In a Human and computer interaction-based system, distance estimation for computer vision between camera and human face is vital. There have been very limited researches on single camera-based distance estimation, which will be faster, reliable and can be used on real time with less computational burden. A 3-D position estimation for human face was proposed on the paper "Face distance estimation from a monocular camera", where location of human's head and face was determined by using motion detection, Hough transform and a statistical color model [4]. Changing pan, tilt and zoom of camera, the face is put on the center of the cameras field of view. Then to measure the distance between human face and an autofocus camera, information taken from focusing the ring are used. A novel method is emphasized in [1] to use devices with monocular camera to determine the depth between the user and the front camera using a back propagation neural network (BPNN). This depth is successively used to calculate the zooming factor for a legible view and to read a document on the display of the mobile device. It is proposed to use frontal facial features acquired from the monocular camera to find the depth information with the use of supervised leaning algorithm. An image processing algorithm has been proposed by [2] to measure the distance from the background. A single camera is fixed at a stationary position to capture the real time image of targeted object and determine its distance in contrast to existing and most common vision algorithms of stereo vision. The proposed method is a statistical method. A two-camera system was proposed in [3] to detect the face from a fixed, wide-angle camera, which estimates a rough location for the eye region using an eye detector based on topographic features, and directs another active pan-tilt-zoom camera to focus in on this eye region. In [5], faces are detected in 2D images with a rapid object classifier based on Haar-like features and principal component analysis to create an Eigen space. These algorithms are limited to the computational burden and hard to realize in real time. More over some of them need extra feature from the cameras. Therefore, we are proposing a new technique to measure the distance from camera based on iris estimation and the distance between them. In Section II, the human face estimation including the Haar Classifier, Integral Image and Training algorithm is described. In section III, the iris estimation algorithm is presented. TO measure the distance between the face and camera has been described in Section IV. Finally, section V gives the outline of the implementation of the algorithm and a developed software.

II.LITERATURE SURVEY

An illustration of the six degrees of freedom governing head poses relative to a camera. Prior work has focused on estimation of yaw, pitch, and roll [4]. In this paper, we assume these parameters are known and estimate camera distance from the subject, shown here as distance along the z axis. pitch, and roll of the head with respect to the camera. To our knowledge, these methods do not attempt to estimate the distance between the camera and head; Figure 2 illustrates the difference. In this section we discuss works most similar to our own. In [1,2], Liu et al. study the effect of face recognition by humans when viewing faces at different perspective convergence angles (effectively focal length or field of view). The study involved a training phase in which face images were displayed to a human test subject. In a later recognition phase the subject was shown images of faces and asked to determine whether each face had been previously displayed. The field of view was changed to see if this had an effect on recognition. Their results show that even humans have a hard time recognizing a face when viewed under different levels of perspective distortion. This is a motivating factor since if humans have trouble with this task, a computer vision algorithm will likely also have the same troubles. Predicting the distance between camera and face is a first step in mitigating the effects of perspective distortion. A similar psychology based studied is presented in [5,6]. Here, Perona et al. investigate the effects of perspective distortion as visual cue for social judgement of faces. Human subjects were asked to judge an image of a face in terms of trustworthiness, attractiveness, and competence. Their results show that for social judgements, pictures taken up close are generally rated lower, while pictures taken far away have higher ratings. In automatic camera calibration, camera parameters are recovered using prior information about the imaged scene. In [7], Deutscher et al. recover camera parameters under the assumption the scene satisfies a Manhattan world criterion. This is similar to our technique, which assumes human fiducial locations are approximately distributed according to an estimated distribution. In [8], Lev et al. use a human subject for calibration, but unlike this work requires multiple frames of video. In [9], Krahnstoever and Mendonca use a full human body for calibration from a single image, where this work uses just the head. In [3], Ohayon and Rivlin present head tracking as a camera pose estimation problem. Prior to head tracking, 3D points are acquired from the head. During tracking, correspondences between the 3D points and their imaged 2D points are used to estimate head pose by solving the inverse problem, namely camera pose. They use the Perspective n-Point (PnP) formulation to solve for the camera extrinsic parameters (rotation R and translation T). The PnP method is also known as the Location Determination Problem and was first coined in [10]. In effect, the human head is used as a calibration rig. In this paper, the authors show that head pose can be accurately estimated and tracked under varying yaw, pitch, and roll and translations about x and y axes. However, they assume knowledge of the ground-truth fiducial locations and do not address dramatic changes in camera distance. Our work is based on [3], but we focus primarily on translation along the z-axis, which affects the level of induced perspective distortion. We present a method for estimating the pose of a previously unseen human head using a dataset of exemplar human heads. Efficient Perspective n-Point (EPnP): The method uses EPnP, a fast, non-iterative, solution to the PnP problem [11]. We use code provided by the au-thors2. As stated earlier, the PnP problem is to estimate the pose of a calibrated camera from n 3D-to-2D correspondences. In particular, EPnP enables us to Esti-mate camera pose based on a set of 2D fiducial locations and their corresponding 3D locations. Exemplar 3D heads: Note the geometric configuration of fiducial features varies from face to face, but in general fiducial locations tend to form clusters, as il-lustrated in Figure 3. This means the fiducial locations of a new person are likely to be similar to those in an exemplar set. We take advantage of this by using a set of exemplar 3D heads to estimate the camera pose of a novel head.

III.EXISTING SYSTEM

• Calculating the distance between the tv (camera) and persons using Image processing.

• Based on the distance this system will control the on and off condition of TV.

IV.PROPOSED SYSTEM

1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which and with the Arduino Due that operate with 3.3V. The second one is a not connected pin that is reserved for future purposes. At mega 16U2 replace the 8U2.

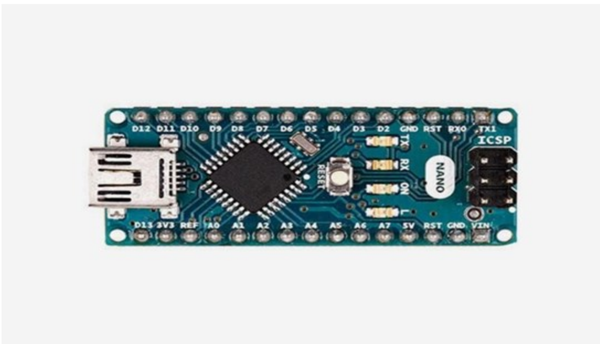

Fig 4.1: Arduino Nano

The Arduino nano is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The nano differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

V.SYSTEM ARCHITECTURE

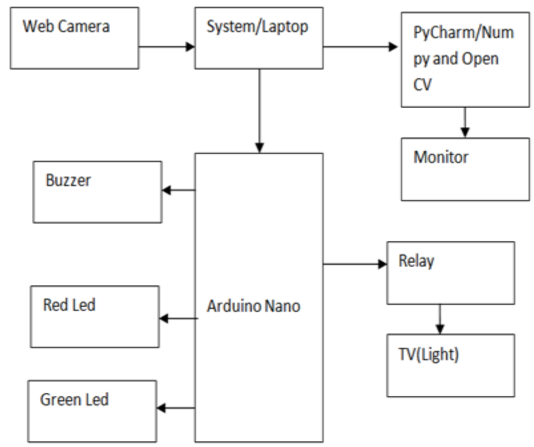

Figure 5.1 System Architecture

The iris image should be rich in iris texture as the feature extraction stage depends upon the image quality. To verify and check the dependency of implemented algorithms for face and iris detection, both high resolution and low-resolution images are used here. For the experimental setup, a built in 2MP camera from the laptop and an external 720 P HD web cam were used. The approximate distance between the human face and the camera started from 10 cm. The image acquisition setup is given in Figure 6. To interface this implemented software directly to the webcam JMF tool was used [11] - D, Fig. 3: Image acquisition Implementation steps of proposed algorithm are: 1) Initially the software gets connected with the webcam, reads the input image as described

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in V and takes the snap shot from live video. It is possible to select the video or image resolution based on the requirement. 2) In the next step, it removes noise using Gaussian filter. 3) Then threshold is applied based on the range of RGB pixels. If pixels value is greater than threshold value, then the background is selected and threshold value is 0 otherwise value is 1. 4) After this preprocessing of image, Harr-like classifier is used with Ad boost algorithm to estimate human face. If the human face is absent then it requests for another frame form the video stream. If it estimates a face, it passes the image to the next step. 5) From the estimated face area, canny edge detection algorithm gets the edges of the objects. Afterwards, Hugo transform gets the circular iris. If it does not have both the iris or if eye is not present, it discards the image and asks for another instant. 6) In this step, it finds the position of the centroid of the iris and radius of the circle, and calculates the distance between the iris. 7) Finally, the estimated distance between two iris is passed to the algorithm described in IV.

VI.OUTPUT SCREENSHOTS

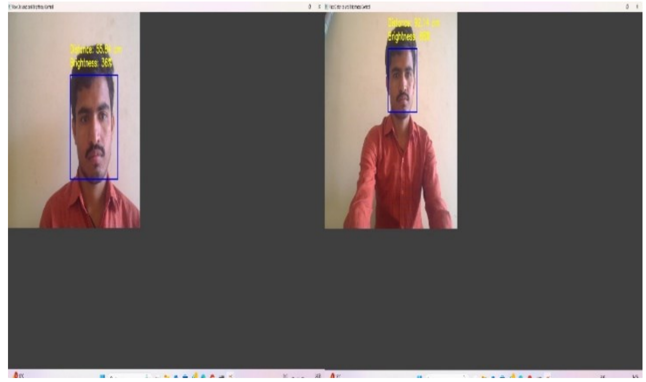

Fig no: 6.1 Software Output

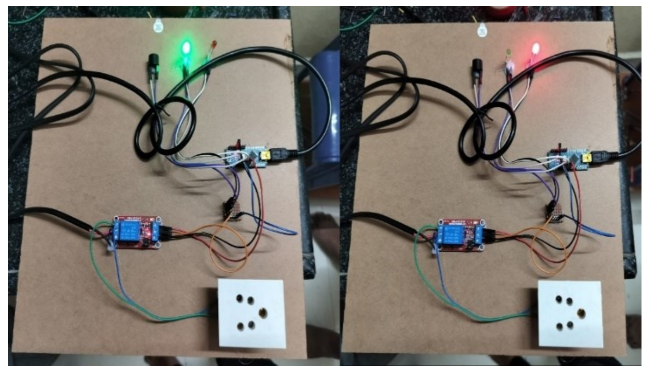

Fig no: 6.2 Hardware Output

VII.CONCLUSION

In this project, a new approach for face to camera distance measurement has been proposed. The estimation method is simple but faster and gives reliable and accurate result for real-time application. With algorithm, the classifier estimates the face and Hugo transform with canny edge detection gives the estimated eye. The classifier is a onetime factory implement. There for, the approach is fast enough for real-time application and reduces computational burden. From the estimated iris centroid and the distance between them, the proposed method can estimate the distance from camera to face up to 40 cm. After that, the linearity relation could not be maintained and the error increases. The future work should focus on this. The specific distance and system adaptive experiment verify the feasibility for real-time application.

VIII.FUTURE SCOPE

Machines are used in every part of human life. Machines work according to us but in today's world, we work according to machines. The rush to soar high is immense. Hence, machines are important and so are the parts of them. If the parts do not fit well a machine cannot work properly. The dimensions of the objects sure make a great impact. This AI IOT based project will help in measuring the dimensions in real-time. It is convenient and easy to use. It also gives accuracy and assurance of the manufactured product. As it is a one-time investment it surely has a great future scope.

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