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A Survey on Covid Norms Checker with IoT based Health Monitoring

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Abstract - *After the outbreak of Covid-19, Human Contact has become an important factor. The more people are in contact towards other objects or people, the more the chances of spreading the virus will increase. This project will help to reduce the contact and to make sure the spreading of virus can be controlled. In this project, we would be making use of a face recognition algorithm for detecting spitting on a person's face and taking necessary actions. The project also presents detailed work on crowd detection using OpenCV. Along with this the system has a pulse oximeter installed which collects users' oxygen level and heart rate data which is then sent to Telegram Cloud with their image captured using ESP32 Cam Board.*

***Key Words*: Face Detection, OpenCV, Haar Features, Cam Board, Dlib Model**

1. INTRODUCTION

Face detection is computer vision technology that helps to locate human faces in digital images. With the advancement of technology, face detection has gained importance especially in fields like photography, security and marketing. People counting systems which can get the exact count of people either indoor or outdoor has a wide range of applications in view of permeating systems. These people counting systems are widely used for promotional evaluation, to get the demand ratio in a retail environment and in crowd management surveillance. In this project we would be making use of a face recognition algorithm for detecting spitting on a person's face and taking necessary actions. The project also presents detailed work on crowd detection using OpenCV. Along with this the system has a pulse oximeter installed which collects users' oxygen level and heart rate data which is then sent to Telegram Cloud with their image captured using ESP32 Cam Board.

2. LITERATURE REVIEW

One of the most famous early research on face recognition systems was performed by Kohonen [1], who demonstrated face recognition using a simple neural net for normalized face images. A different algorithm for face detection was implemented in [2] which is based on skin colour detection by compensating for lighting conditions followed by an elliptical skin model for detection. Based on the orientation of the face, ellipse vote and eyes/mouth maps, a face score is computed for each verified eye-mouth triangle followed by Hough transform to extract the best fitting ellipse. The feasibility of utilizing a face recognition system in a real time environment has been described by [3]. They utilize Neural Networks for classifying faces and recognition tasks so as to achieve high accuracy. Further improvement is obtained by utilizing deep learning-based feature extractors. As demonstrated in [4, 5], a CNN based feature extractor coupled with a SVM based classifier gives very high accuracy. Detection of objects by using a cascade of simple features was mainly introduced by researchers for face detection [6], [7]. The role of Haar features extracted from an integral image in object detection is elaborated in their work. Some researchers explain a framework that can be trained for object detection [8]. From a set of wavelet basis functions, an object class is derived and is used as an input to support vector machines. Many studies have been carried out to detect humans in a scene by using part-based human detectors [9–11]. Parts may not be clearly visible as they depend on factors such as inter- object occlusion, illumination, etc. Some other research has been carried out to detect presence of humans based on foreground segmentation [12-14]. The background is subtracted from the frame and some types of filtering, for example Gaussian filtering, is done to extract human motion blobs out of the frame. This process is usually done in a grayscale image. The motion blobs are then processed to determine its similarities with that of humans. Illumination variation in different regions give rise to split motion blobs and hence it becomes challenging to formulate a shape for human detection. Density based head detection has been demonstrated by some researchers [15].

Jie Yang; A. Waibel (2012) conducted a research paper where they present a real-time face tracker. This system has achieved a rate of 30+ frames/second using an HP-9000 workstation with a frame grabber and a Canon VC-Cl camera. It can track a person's face while the person moves freely (e.g., walks, jumps, sits down and stands up) in a room. They present a model to characterize skin colour distributions of human faces. The information provided by this model is sufficient for tracking a human face in various poses and views. This model is adaptable to different people and different lighting conditions in real-time.

Rein-Lien Hsu (2007) researched has proposed a face detection algorithm for colour images in the presence of varying lighting conditions as well as complex backgrounds, their method detects skin regions over the entire image and then generates face candidates based on

the spatial arrangement of these skin patches. The algorithm uses eye, mouth, and boundary maps for verifying each face candidate.

Shanshan Guo (2005) wrote in his research that they combined Convolutional Neural Network (CNN) and Support Vector Machine (SVM) to recognize face images. With the input of face images extracted from CNN, SVM will recognize face images more accurately. In this experiment, some face images in the database are used for pre-training, and the database is used for training and testing. The results show efficiency with a high recognition rate and less training time.

P. Viola (2015) conducted research that describes a machine learning approach for visual object detection which is capable of processing images extremely rapidly and achieving high detection rates. Their work is distinguished by three key contributions. The first is the introduction of a new image representation called the "integral image". The second is a learning algorithm, based on AdaBoost. The third contribution is a method for combining increasingly more complex classifiers in a "cascade".

Stoimen Stoimenov (2013) research presents a face recognition system that is developed in Android for mobile phone face unlock verification of several users. For the classification task standard, neural networks structures in Java are used as a classifier by implementing the classical Feed-forward Neural Network (NN) with a backpropagation algorithm.

Souhail Guennouni (2010) conducted a research paper where they presented a developed application for multiple object detection using OpenCV libraries. The complex aspects that were in the object detection using cascade classifier are described in this research. Furthermore, they have discussed the profiling and porting of the application into an embedded platform and comparing the results with the regular platform. The application deals with real-time systems implementation and indicates where the cases of object detection may be more complex and where it may be simpler.

Geovany A. Ramirez (2012) presents a system for multi-pose face detection. Their system presents three main parts. First, they introduce the use of Haar features. Haar features provide a rich feature space, which allows building classifiers that are accurate and much simpler than those obtained with other features. The second part is the use of an algorithm to search a large parameter space of potential features. The third part is the application of a skin colour-segmentation scheme to reduce the search space.

C.P. Papageorgiou (2002) presents a trainable framework for object detection in static images. The first system is face detection and the second is the domain of people which, in contrast to faces, vary greatly in colour, texture, and patterns. Unlike previous research, this system learns from examples and does not rely on a hand-crafted model or motion-based segmentation. This paper also presents a motion-based extension to enhance the performance of the detection algorithm over video sequences. The results presented here suggest that this architecture may well be quite general.

Masakazu Matsugu (2007) research proposes a model for face recognition using a support vector machine. The feature vector is composed of a set of local output distributions. The set of local areas are automatically selected around facial components (e.g., eyes, mouth, nose, etc.) detected by the CNN. Results demonstrate highly efficient performance both in face recognition and detection as well.

Ashwin Dehghan (2001) published his keynote paper, presenting two states of the art methods for automatic pedestrian tracking in videos with low and high crowd density. For videos with low density, they detect each person using a part-based human detector. Then, they employ a global data association method based on Generalized Graphs for tracking each individual in the whole video. In videos with high crowd density, they track individuals using a scene structured force model and crowd flow modelling.

3. DETAILED INFORMATION

3.1 SPITTING PERSON FACE RECOGNITION

The working of the system starts with creating a database of identified faces. An automated image capture is used to capture 100 images of each user whose face data needs to be registered in the system. These 100 images are stored with a unique id for each user. After images of each user are captured the training of these images is done. Once the training is done the system can now recognize faces of users in the database. For the above steps OpenCV is used. Dlib model is used to find out whether a person is spitting or not based on the Mouth Aspect Ratio of the user. The complete system works as follows: If a person is spitting it is verified by the dlib model. The dlib model calls the recognizer OpenCV model to recognize the face of the spitting person. If a person is found to be spitting the person is charged with a fine along with an alert.

3.2 CROWD DETECTION

The system will be developed using MobileNettSSD Model and Haar Features for determination of number of persons in the frame. The system when activated would capture live frames and determine the number of persons in the frame. If the number of persons remains less than the threshold then the system will run in the main loop. Once the number of persons exceeds the threshold a message of alert will be printed on the terminal.

3.3 PULSE OXIMETER SYSTEM

An oximeter that measures the proportion of oxygenated haemoglobin in the blood in pulsating vessels, especially the capillaries of the finger or ear.. The system has a pulse oximeter installed with a ESP32 Microcontroller board which collects users' oxygen level and heart rate data This data is then sent to Telegram Cloud with their image captured using ESP32 Cam Board.

4. CONCLUSION

After reading a couple of research papers, we have decided to use OpenCV as our library and dlib model for spitting detection. We look forward to storing more than 25 faces in order to detect the exact person who is responsible for spitting. For Crowd Detection, we are considering the Haar Features and we will be focusing mainly on the head counts instead of the whole body because getting the circumference of the whole body is difficult in a crowded area. Lastly, a Pulse Oximeter will also be used in order to check the Oxygen Level and all this data will be transferred to Telegram Cloud storage.

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