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AUTOMATED DOOR LOCK USING FACE AND VOICE RECOGNITION

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Abstract:

In modern era, the security concerns have grown enormously. The security of restricted areas such as secret offices or buffer zones is of extreme importance.Monitoring such areas rely currently on technology and man power, however automatic monitoring has been advancing in order to avoid potential human errors that can be caused by different reasons. Hence the automated door lock using face and voice recognition is being proposed. The real-time face recognition has been made feasible by applying the method of Haar Cascade, Convolutional Neural Network. The proposed work initially capturing video/image of all the permitted persons using camera module and records the information into database. Then automated system recognizes and classify the Faces using CNN(Convolutional Neural Network) algorithm, and then voice recognition using code word with google speech-to-text. The real-time Camera module face detection has been made feasible by applying of Haar Cascade algorithm. The software first \staking Camera module of all the allowed persons and stores the information into database. Proposed work focuses with automated method to detect face and recognize the individual. Display that person name; classify weather live or not using CNN algorithm. The process comprised of three parts, first take footage and transform it into s-frames. Next use CNN for the purpose of classification, and third match the code word using google speech-to-text API.

Keywords: CNN(Convolutional Neural Network), Machine learning, Artificial intelligence, Haar Cascade

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1. INTRODUCTION

The Face is commonly used biometric to recognize people. Face recognition has received substantial attention from security guard due to human activities found in various applications of security like forensic, airport, face tracking, criminal detection, etc. Compared to other biometric traits like palm print, finger print, palm print etc. They can be taken even without visitor knowledge and further can be used for security based applications like criminal detection, face tracking, airport security, and forensic etc. Face recognition involves capturing face image from a from a web camera. They are capture image of visitor and compared image with the stored database. Classify them with known classes and then they are stored in the database. Face biometrics is a challenging field for researchers with various limitations imposed for machine face recognition like variations in change in illumination, head poses, facial expression, occlusion, aging etc. Various approaches were suggested by researchers in overcoming the stated. Automatic face recognition involves feature extraction and face recognition, face detection. Face recognition algorithms are classified into two classes as geometric feature based and image template based. The template based methods compute correlation between one or more model templates and face to find the face identity. Principal component analysis, kernel methods, linear discriminate analysis etc. are used to create face templates. The geometric feature based methods are used to analyse explicit local features and their geometric relations .Multi resolution tools such as ridge lets were found to be useful for analysing information content of images and found its application in pattern recognition, and computer vision, image processing

2. Objective

• To identify the face of persons in the image.
• To improve the face detection performances in the system.
• To improve the Accuracy of security performances in the system we are using voice code word authentication.

3. LITERATURE SURVEY

X. Wei, C.-T. Li, Z. Lei, D. Yi, and S. Li [1] Facial recognition (FR) systems in real-world applications must deal with a range of interferences, such as occlusions and disguises in face photographs.

P. J. Phillips, J. R. Beveridge, B. A. Draper, G. Givens [2] The administrators of most educational institutions are concerned about student absences. The Good, the Bad, and the Ugly Face Challenge Problem was established to encourage the development of algorithms that can recognise changes in still frontal faces throughout many alterations.

Y. Taigman, M. Yang, M. Ranzato, and L. Wolf [3] Identify, alignment, describe, and classify are the four phases of the standard face recognition process.

J. Wright, A. Y. Yang, A. Ganesh, S. S. Sastry, and Y. Ma [4] The way we use sparsity for classification is very different from the many parsimony approaches we mentioned earlier. Rather than using sparsity to find a relevant model or relevant features that can then be used to classify all test samples, it uses the sparse representation of each individual test sample for classification directly, adaptively selecting the training samples that give the most compact representation.

Yigang Huang, Namgyu Kang [5] We explain how a metaphorical door handle affects users' opening-door actions and what kansei value a metaphorical door handle delivers in this study. To do so, we used a sample of 200 students from Future University Hakodate to perform a survey with 12 door handles (created in 3D max). Each feature was rated on a scale of -2 to 2 based on five evaluation criteria. For an integrated survey, the data was computed as average scores, followed by visual information and principal component analysis. As a result, we can see how a metaphorical door handle can affect users' opening-door behaviour. Aside from that, we discovered that a door handle with an acceptable metaphor expression is unique and appropriate for use.

Mone Kijima, Yuta Miyagawa, Hayato Oshita [6], Our research team is hard at work on Internet of Things-based robust emergency and catastrophe protection systems capable of relaying tsunami data from infrared sensors. It is critical to generate infrared sound on a frequent basis in order to assess the sensor's functionality. As a result, in our experiment, we used one sensor to detect the state variation of numerous doors, and we took into account the infrasound produced when opening and closing doors. We created and tested the detecting system for numerous doors.

Jiajun Li1 , Jianguo Tao1*, Liang Ding1 , Haibo Gao1 , Zongquan Deng1 ,Yu Wu2 [7], In order to do home service and rescue work, robots need to be able to unlock doors. Obtaining the right dimensions, such as the

door's width and the handle's length, is a considerable challenge. Many research use computer vision techniques to automatically extract the characteristics because of the complexity of the environment, which results in good but not very consistent results. RGBD sensors and a graphical user interface allow users to "point" at the desired spot with a mouse to retrieve 3D data. This system is available from our company. Picked locations are used to develop algorithms for extracting important parameters. When the robot's orientation is out of alignment with that of the door plane's normal, excessive internal forces are created. To overcome this, we build a module that really can compute the plane's normal by pointing at three noncollinear points. A real robot was used for the testing. It indicates that the GUI and algorithms designed by the researcher may assist in discovering the necessary parameters and preparing the robot for future tasks.

4. PROBLEM STATEMENT

The security of restricted areas such as secret offices or buffer zones is of extreme importance. Monitoring such areas rely currently on technology and man power, however automatic monitoring has been advancing in order to avoid potential human errors that can be caused by different reasons.

5. GOAL

The goal of the proposed system is to maintain security for required applications. Firstly, face detection is carried out to infer the correct face and then it will check the database, the user is authorized or not. Also system have goal to cover a security in the form of code word through voice.

6. PROPOSED SYSTEM

This paper is presenting a proposed work of an automated image capturing system using Python . This work is experimented on user’s face. We have used classification methods Haar Cascade, CNN convolution neural networks algorithm, etc. But improvements are expected to increase its efficiency of classification. This system automatically detects the user face and identifies the individual the by recognizing their face. This system is developed by capturing real time human faces. The detected faces are matched against the reference faces in the database and detect the user. Voice based authentication using code word is done using google speech-to-text API.

Advantages of Proposed System:

- We perform a detailed security analysis and performance evaluation of the proposed data.
- Required less time.
- Increase Efficiency.
- improve the accuracy.
- voice based authentication.

7. SYSTEM ARCHITECTURE

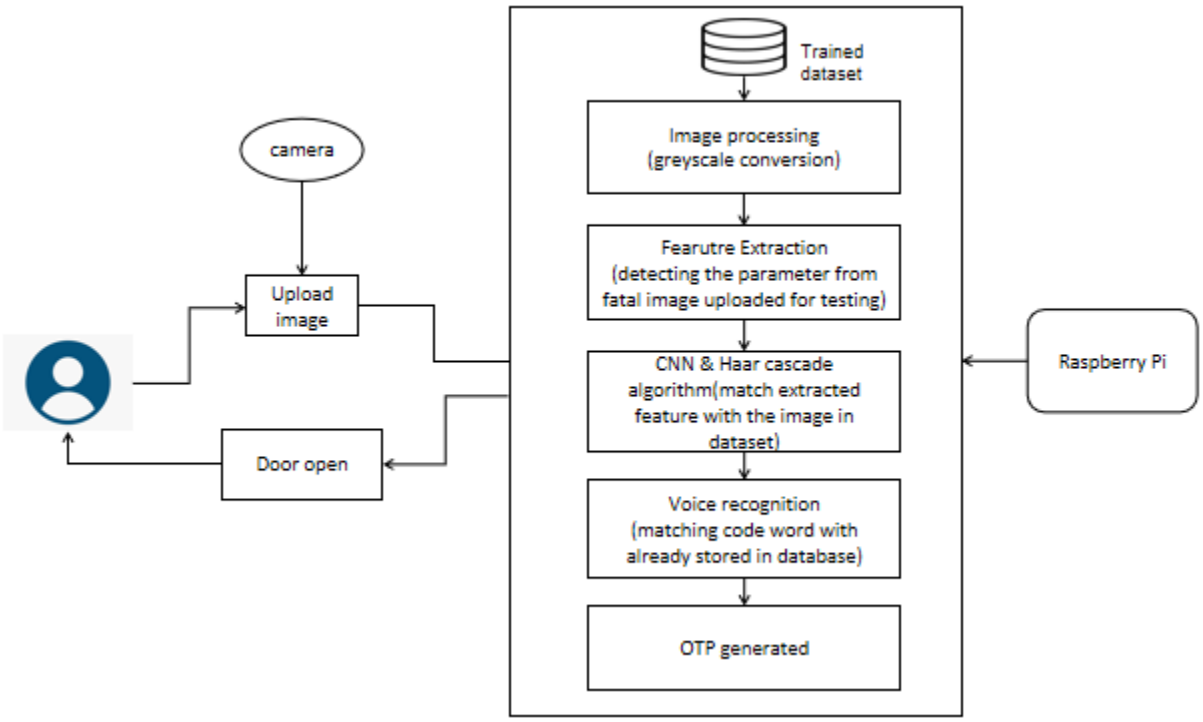


Fig.System Architecture

Mathematical Model:

Let S be the Whole system which consists:

S= IP, Pro, OP.

Where,

IP is the input of the system.

Pro is the procedure applied to the system to process the given input.

OP is the output of the system.

A. Input:

IP = I. Where, I is set of images, provided as an input.

B. Procedure:

Step1: Camera module capture the user face .

Step 2: verify the information into database.

Step 3: Proposed work deals with automated system to detect and classify the Faces using Convolutional Neural Network algorithm

Step 4: The comprised of three phases, first face Detection from camera module , second apply Convolutional Neural Network algorithm for the purpose of feature classification and extraction.

Step 5: The most useful and unique features of the face image are extracted in the feature extraction phase.

Step 6: The face image is compared with the images from the database.

Step 7 : we empirically evaluate face recognition which considers both shape and texture information to represent face images based on Convolutional Neural Network for person independent face recognition.

Step8: As per comparison show Result.

step9: system using voice recognition by code word using google api for more authentication

C.Output: Camera module detects the face and show the locks/unlocks the door with voice recognisation.

8. METHODOLOGY :

8.1. Camera Module :

This is the first step of the following system.As soon as any face is detected in the frame hence camera starts taking pictures and video which is processed in further step.

8.2. Face Detection :

The Haar cascade classifier is the very successful method of Viola and Jones for face detection Generally, many object detection tasks with rigid structure can be addressed by means of this method, not limited to face detection. Here detected face is processed in further step.

8.3. Face Recognition & Liveness Detection :

CNNs are a category of Neural Networks that have proven very effective in areas such as image recognition and classification. Liveness is detected of the object in front of camera using Convolutional Neural Network algorithm. In this phase CNN is used for recognition of face by the automated system.

8.4. Voice Authentication :

The Google speech-to-text API allows developers to convert speech into text by leveraging Google's years of research in automatic speech recognition and transcription technology. The API helps users add speech functionality to their applications to better serve consumer needs**.** Code word is matched with the code-word with the respective person's code-word stored in database with the help of Google speech-to-text API. In this step, recognized person's code-word is matched with the one in the database stored .

8.5. OTP

The Simple Mail Transfer Protocol or SMTP is the Internet standard for sending and receiving emails. Email clients use SMTP to send messages to a mail server for delivery while email servers use it to forward messages to their recipients. Once an individual is confirmed through face and voice recognition, an otp is sent on that individual's email with use of SMTP protocol.

IX. ALGORITHMS

1. Haar Cascade Algorithm:

Object identification using Haar feature-based cascade classifiers is a detection method developed by. This is a Machine Learning-based method in which the cascading functions is formally defined number of positive and negative photos before being used to detect objects in other photos. Face recognition, for example, necessitates a huge number of both positively and negatively images (images with and without faces) to train the classifier. The characteristics are then extracted. For this, the haar features depicted in the figure below are used. Each feature is a single value calculated by subtracting the sum of pixel values beneath the white rectangle from the sum of pixel values beneath the black rectangle. To handle each feature calculation that takes a lot of processing, a simple solution known as integral pictures was presented. It lowers the calculation of the pixel sum to a four-pixel operation. The majority of the traits we calculated are also meaningless. As a result, we must select the best characteristic from among these. For this aim, every feature is applied to all of the training photographs. It selects the best threshold for each attribute to classify the faces into positive and negative images. The attributes that best categorise face and non-facial photographs with the lowest mistake rate are then picked. Applying all of the final features to an image to determine whether or not it is a face is still inefficient and time-consuming. (Take a look at the 24x24 window of each image.) As a result, the concept of Cascade of Classifiers was established, in which features are organised into different stages of classifiers and applied one at a time, rather than applying all of them to a window at once. If the window fails at any stage during the procedure, it is abandoned and no further steps are taken. If it passes, the process moves on to the application of the second level of features. A face area is a window that passes through all stages.

2. CNN Algorithm:

A convolutional neural network (CNN/ConvNet) is a type of deep neural network used to evaluate visual imagery in deep learning. When we think about neural networks, we usually think of matrix multiplications, but this isn't the case with ConvNet. It employs a technique known as Convolution. Perception is a mathematical operation on two components that yields a quaternary structure that explains how the shape of one is changed by the other. Various levels of neurones make up deep neural networks. Artificial neurons are mathematical in

nature that compute the weight value of multiple outputs and inputs an activity value, similar to their natural counterparts. Each layer generates many activation functions that are passed onto next layer when you input an image into a ConvNet. A first layer usually removes basic properties such as horizontally or vertical edges. This information is passed onto next layer, which is responsible for detecting more complex features like angles and combinational edges. As we go deeper into the network, it can recognise even more complex features like items, continues to face, and etc.

9. IMPLEMENTATION

9.1. Registration / Login

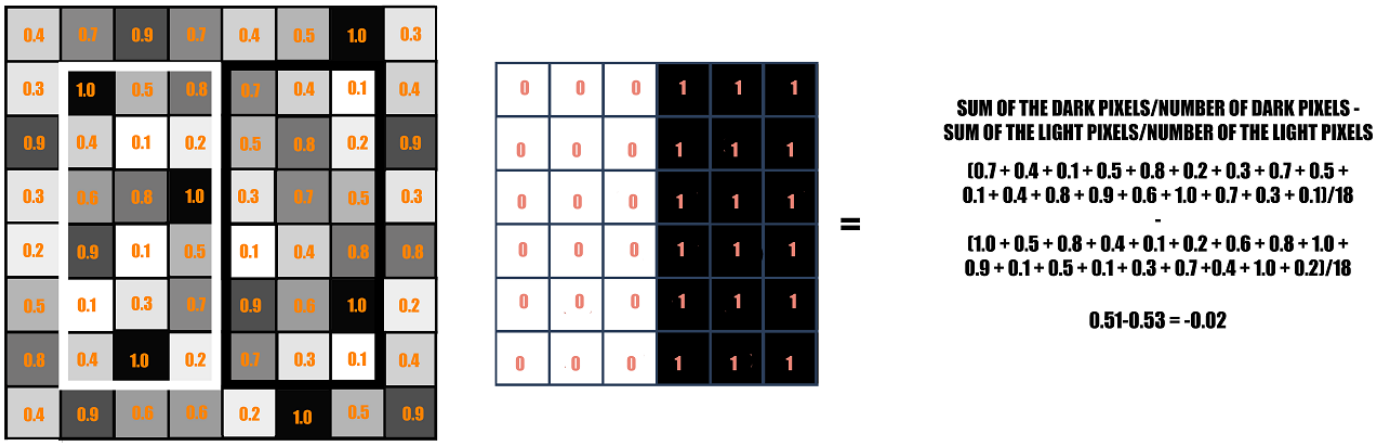
This is the first module of the proposed system. The user needs to be registered to get access through the automated system in future. Once he/she is registered, first step is to step in front of the camera. When he/she is in front, the camera starts taking photos and videos to process as soon as a face is detected in the frame.

9.2. Creating face data

In this module, we create face data while registering the user by capturing s-frames of the person detected in that frame. Face detection is carried out using Haar-cascade calssifier. We use that data to train our machine learning model, with the use of CNN (Convolutional Neural Network) algorithm.

9.3. Face Detection

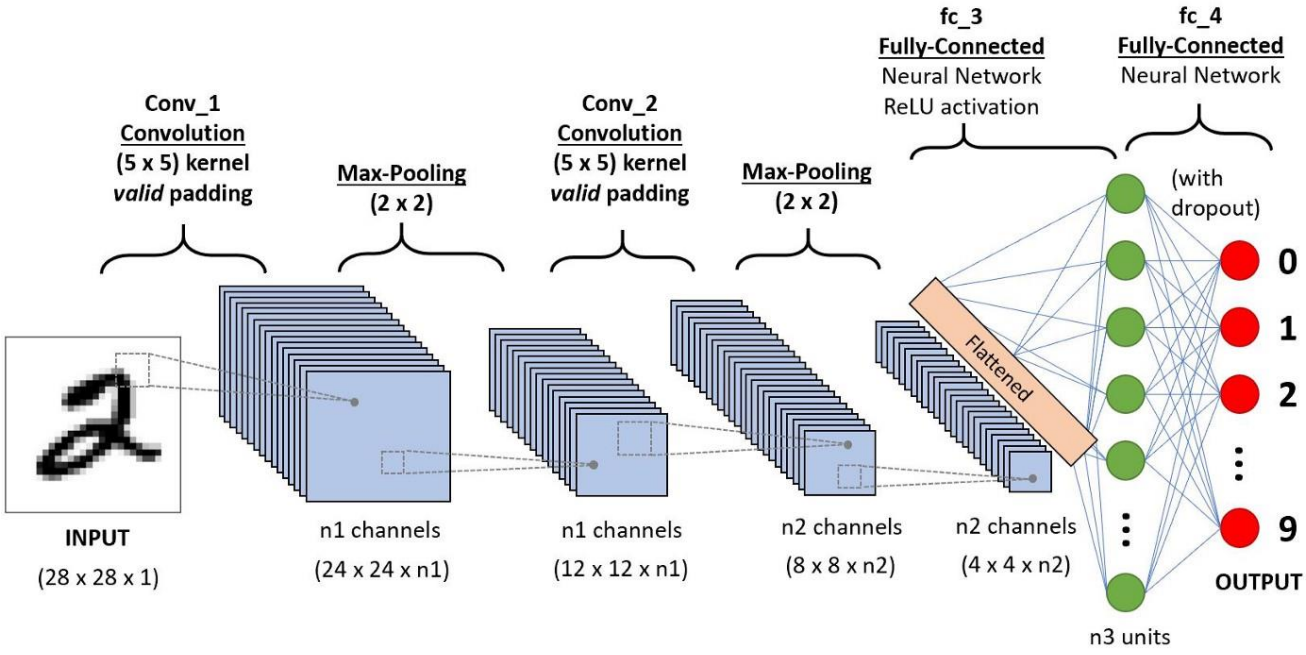
When the face is detected, the system starts further process. Here we have used Haar-Cascade algorithm for face detection.It is an Object Detection Algorithm used to identify faces in an image or a real time video. The algorithm uses edge or line detection features. It uses a combination of "weak classifiers" to create a "strong classifier" that the algorithm can use to detect objects. Weak learners are created by moving a window over the input image, and computing Haar features for each subsection of the image.



The rectangle on the left is a sample representation of an image with pixel values 0.0 to 1.0. The rectangle at the center is a haar kernel which has all the light pixels on the left and all the dark pixels on the right. The haar calculation is done by finding out the difference of the average of the pixel values at the darker region and the average of the pixel values at the lighter region. If the difference is close to 1, then there is an edge detected by the haar feature.

9.4. Face recognition and liveness detection.

In this module, the detected face is matched with the faces in database to recognize the person and display it's record. Liveness detection is carried out by capturing small features of face like eye-blinkung, etc. to identify weather the following person is real or a cut out picture of the concerned person's face. This is carried out using Convolutional Neural Network algorithm. A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. For the proposed system, Convolutional Neural Network algorithm is used for face classification.



9.5. Voice verification

After the proposed system recognizes the person, user shall speak the code word they have saved in the database during registration process. Once he/she speaks the word, it is then converted into speech and then the word in matched in the database. If the word is matched, the system process to the next module. For this purpose google speech-to-text- api has been used. Speech-to-Text can recognize distinct channels in multichannel situations (e.g., video conference) and annotate the transcripts to preserve the order. Speech-to-Text can handle noisy audio from many environments without requiring additional noise cancellation.

9.6. OTP

The verified person is then required to enter the otp which is sent to their e-mail id after voice verification.once the otp is entered, the individual is granted the permission. To send mail, simple mail transfer protocol (smtp) has been used.

X. RESULT

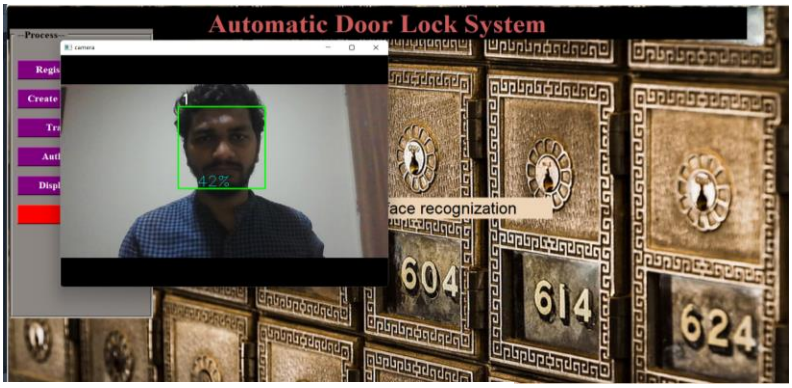


Figure 9.2.1 Output of face recognition.

The figure (9.2.1) is the outcome of the Face Recognition. This picture is taken by the Raspberry Pi camera which is used for the face recognition. Firstly taking the pictures and storing it in the database then during the recognition process the outcome shows the name of the identity if it is stored in the database and it also shows the matching index which is previously mentioned that if it is 40% or more then it is successful otherwise not.

Figure 9.2.2 Output of face recognition process.

The figure (9.2.2) is the outcome of the Face recognition. This picture is taken by the Raspberry Pi camera which is used for the face recognition. Firstly taking the pictures and storing it in the database then during the recognition process the outcome shows the name of the identity if it is stored in the database and it also shows the matching index which is previously mentioned that if it is 40% or more then it is successful otherwise not.

The main objective of the proposed work here is to create a system where it will be easy to operate home appliances and equipments very easily by making this system user friendly. Developing a smart home system was not easy at first. The most important part of this proposed work is human surveillance which is important due to the security issues of smart homes. For surveillance using face detection and face recognition is being used which are the most modern form of surveillance. For this purpose Raspberry Pi is being used camera and OpenCV which is a open source which is a part of Python language. Python here acts as the main platform where most of the work is going to be done. Image processing needs to be done for the Face recognition. OpenCV is an open source computer vision software library. The library has a lot of optimized algorithms, which can be used in many IOT related sectors including face detection and recognition. As the libraries of our project we liked to use the Haar classifier, LBPH (Lower Binary Pattern histogram) face recognizer. Face recognition is ought to be successful if the matching index after recognition is more than 40%.

Applications:

Detect frauds at crowded areas such as:

• Banking System,

• Parking Area,

• Government Sector

Disadvantages:

• It is cumbersome to maintain a huge set of records.

• It is time Consuming

• Error-prone

• Its leads to wastage of Resources.

XI. CONCLUSION

The purpose of the project is to build an automatic door lock system. it saves time and energy, specifically when a significant amount of people are involved. It may be expanded to video surveillance to detect people in crowded settings such as bus stops, theatres, and train stations, where the identity of a perpetrators can be determined using facial recognition algorithms. recognition system is a difficult topic in the subject of computer vision, which has gotten a lot of recent interest due to its numerous applications in diverse of fields. despite intensive research efforts in this area, which have resulted in mature face recognition systems that can operate under confined conditions, they are still far from meeting the ideal of being able to perform properly in all of the situations that applications in the real world confront.

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