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Missing Child Identification Using Deepfeature Extraction and Multi Classification

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ABSTRACT: -In India countless number of children are reported missing every year. Among the missing child cases a large percentage of children remain unreached. Deep learning technique is used foridentifying the reported missing child from the photos of multitude of children available, with the help of face recognition. The people can upload photographs of suspicious child into a common portal with landmarks and remarks. The photo will be automatically compared with the registered photos of the missing child from the repository. Classification of the input child image is done and photo with best match will be selected from the database of missing children. So, a deep learning model is trained to correctly identify the missing child from the database provided, using the facial image uploaded by the public. Convolutional Neural Network, a highly effective deep learning technique for image-based applications is adopted here for face recognition. Face descriptors are extracted from the images using a pre-defined CNN model VGG-Face deep architecture. Compared with deep learning applications, our algorithm uses convolution network only as a high-level feature extractor and the child recognition is done by the trained SVM classifier. Choosing best performing CNN model of the face recognition, VGG-Face and proper training of it results in a deep learning model invariant of noise, illumination, contrast, occlusion, image pose and age of child and it outperforms earlier methods in face recognition based on missing child identification technique. The classification performance achieved for achild identification system is 99.41%. It has been evaluated on 43 Child cases.

Keywords— Missing child identification, face recognition, deep learning, CNN, VGG-Face, Multi class SVM.

I. INTRODUCTION

Children are the greatest asset of each nation. The future of any country depends upon the right growth of its children. India is the second largest populated country in the world and children represent a significant percentage of total population. But regrettably, a large number of children go missing every year in India due to various reasons including kidnapping, run-away children, trafficked children and lost children. Extremely disturbing fact about India's missing children is that on an average 174 children are missing every day, half of them remains untraced. Children who are missing may be exploited and abused for various reasons. As per the National Crime Records Bureau report which is cited by the Ministry of Home Affairs (MHA) in the Parliament (LS Q no. 3928, 20-03- 2018), more than one lakh children (1,11,569 in actual numbers) are reported missing till 2016, and 55,625 of them remained untraced till the year end. Many NGOs declare that estimates of missing children are much higher than reported.

Mostly missing child cases are reported to police. The child missing in one region may be found in another region or another state, for various reasons. So even if the child is found, it is difficult to identify him/her from the reported missing cases. A framework and methodology for developing assistive tool for tracing missing child is described in this paper. An idea for maintaining virtual space is proposed, such that the recent photographs of

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children details provided by parents at the time of reporting missing cases are saved in a safe place. The public is given assistence to voluntarily take photographs of children in suspected situations and uploaded in that portal. Automatic searching of photo among missing child case images will be provided in application. This supports the police officials to locate the child anywhere in India.

II. LITERATURE SURVEY

Previously, Pournami S. Chandran and his fellow mates from Centre for Development of Advanced Computing have a presented a paper [2] which deals with a similar problem statement and objective. The system proposed by them makes use of Deep Learning based facial Feature Extraction and matching with SVM (Support Vector Machine)

The images of missing kids are stored in a database. Faces are detected from the images and features are learned by Convolutional Neural Network. These learned features are used to train multi-class SVM classifier. They use this method to correctly identify and label kid.

The main difference between their work and ours is that, here once lost person is found and if the person's face is not already existing in database, the public themselves who found that person can register that face as lost person with the location they found him/her in our portal which was not proposed in their system.

This will help process of searching faster. And their system involves complex algorithms which makes the process of extraction and classification slow. These are the main disadvantages of the previously existing systems.

In August 2016, RohitSatle and his team presented a paper named [3] which addresses a face recognition system built by using Principal Component Analysis (PCA) method. The two main disadvantages of using the PCA method are that computational complexity is high and it can only process the faces that have similar facial expressions.

SwarnaBaiArniker and team have presented a paper [4] which addresses missing people identification system using RFID Technology. The disadvantage of this system is that concerned person has to physically wear RFID tag all time which is infeasible.

BirariHetal and her team have presented a paper [5] where they have used SWF-SIFT to compare faces. But SIFT is computationally heavy and therefore costs lots of time as it is based on Histogram of Gradients where each pixel in the patch need to be computed.

In 2015, Thomas M. Omweri and Andrew M. Kahonge have presented a paper [6] where they proposed a system that makes use of mobile-based web service to search for missing people. Here no modern technologies are used to search. The guardian uploads the details of the missing person in the portal. If any person spots the missing person in the portal, he can report it to the guarding using the contact they provided. This is a very straightforward approach and is inefficient.

In 2016, Professor Sumeet Pate and his team presented a paper [7] in which they used the Line Edge Method (LEM) for face recognition to find missing people. The efficiency of the system was 85%.

In 2018, Peace Muyambo from Zimbabwe proposed a face recognition system to find missing people in Zimbabwe in his paper [8] which used the LBPH method recognize faces. The proposed system had a face recognition rate of 67.5%. LBPH algorithm is not sensitive to the variation of luminosity.

III. PROBLEM STATEMENT

Sometimes the child has been missing for a long time. This age gap reflects in images since aging affects the shape of face and texture of skin. The feature discriminator invariant of aging effects had to be derived. It is the challenge in missing child identification compared to the other face recognition systems. Also, facial presence of child can vary due to changes in pose, orientation, illumination, occlusions, noise in background etc. The image taken by public may not be of good quality, as some of them may be captured from a distance without the knowledge of the child.

IV. OBJECTIVE

To develop a tool for identification of missing child using deep-learning methods of image feature extraction and machine learning method of classification

V. METHODOLOGY

The proposed system makes use of Face Recognition of missing people's identification. The architecture of our framework is presented in figure 1.

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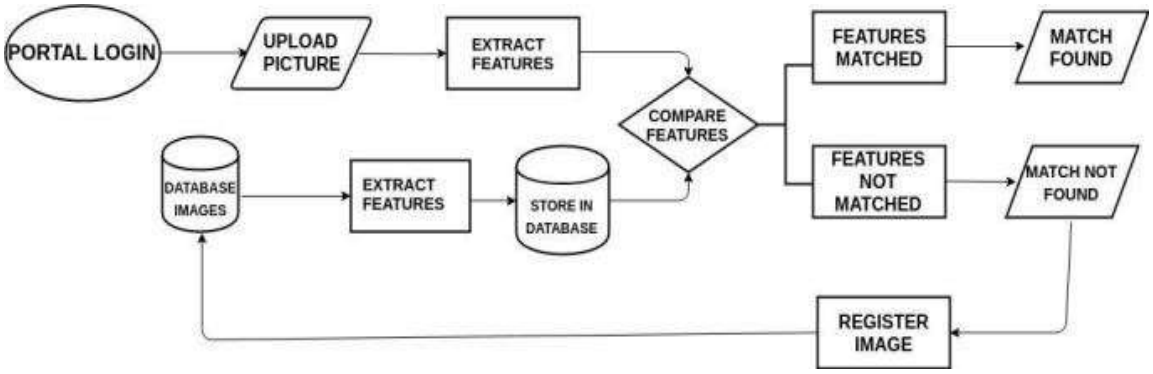

Figure 5.1. Architecture of proposed People Identification System

Here the public or police who finds a suspicious person (child, mentally challenged person, etc.) on the road uploads a picture of that person into the portal. Our algorithm extracts the face encodings of the image as shown in Figure 2 and compare with that of the face encodings of the previously existing images in the database. If match is found, alert message will be sent to both the concerned police officer and the parent/guardian of that person in image. If a match is not found, then the person will be provided with the option of registering that face as a new entry to our database with the location they found and remarks.

128 MEASUREMENTS GENERATED FROM IMAGE

-0.06827972	0.216005	0.09233782	-0.08997745	-0.13584685
0.06604465	-0.06795903	-0.02622151	0.14736192	-0.00864729
0.18711212	0.02173115	-0.24464363	0.01354032	-0.12047479
0.10333548	-0.16254933	-0.10179078	-0.13826165	-0.07660741
-0.05619285	0.09155109	-0.09188037	0.02943955	-0.05959552
-0.31188631	0.00946294	-0.03328615	0.15845376	-0.13181253
-0.05466102	0.14445204	-0.19930251	-0.06848137	0.03044515
0.07902281	-0.01709633	-0.08155417	0.22431383	0.1146391
-0.13481773	0.07263192	0.05127752	0.29953676	0.14499897
0.039961	0.04723749	-0.05751262	0.21064278	-0.27604735
0.12465153	0.20722246	0.15233621	0.06840158	0.05619281
-0.3095212	-0.02087676	0.09142256	-0.19117616	0.14651392
0.07310466	-0.09613065	-0.09899651	-0.0888036	0.09228703
0.11667377	-0.0675838	-0.15971757	0.19461912	-0.0903353
0.01968301	0.11547504	-0.04396552	-0.10485076	-0.19259949
0.1476192	0.39615291	0.22919193	-0.18583539	-0.02374287
-0.07060452	-0.08534201	0.04251482	0.03616514	-0.15720892
-0.05652554	-0.0698254	0.03088889	0.19048047	0.11119351
-0.04862998	0.2257539	0.05033901	0.02974295	-0.01265951
0.03924655	-0.16493455	-0.04342845	-0.11758161	-0.03780931
0.06889786	-0.12921754	-0.04310762	0.10844693	-0.18276887
0.14725408	-0.00629703	0.00725	0.01006189	-0.0039731
-0.08337669	0.0194875	0.21966641	-0.22433993	0.22438575
0.12373739	0.04024307	0.13579892	0.18172947	0.05101738
0.08391161	-0.11616194	-0.10710406	-0.19598569	0.07729487
-0.07229772	0.0314967	0.0330605		

Figure 5.2 Face Encodings generated from an input image

Whenever public or police upload an image, the face encodings of the image are extracted and then compared to the face encodings of the images stored in the database. If distance between encoding of uploaded image and encoding of image in database is less than or equal to the threshold, then the face in both the images is of the same person as shown in Figure 3 and Figure 4. If that is the case, the user is notified that a match is found along with the picture from the database that matched with the uploaded picture. If the distance between the encodings is more than the threshold, it means that the faces in the images are not of the same person's. By this way, our proposed system will help in identifying the missing people.

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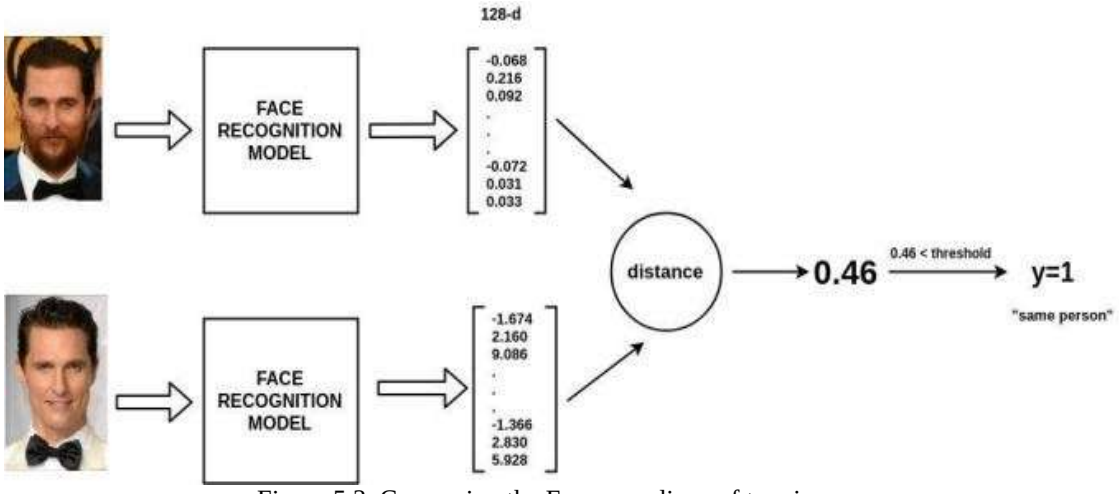

Figure 5.3. Comparing the Face encodings of two images

The model we used involves three main steps to perform face recognition.
STEP 1: Face detection – Firstly, face patterns are generated using Histogram of Oriented Gradients algorithm. The images are made black and white. Here, part of images that looks more like original HOG face pattern is found. Finally, the detected face was bounded by a bounding box.

STEP 2: Landmarks that are existing on every face are figured out by using the face landmark estimation algorithm. From landmarks found, image transformations like scaling, shearing and rotation are used by OpenCV's affine transformation to make the lips and eyes appear in the same location on every image.

STEP 3: Face images are passed through deep convolutional neural network. By doing this, we obtain 128 measurements which are 128-dimensionhypersphere. And no one knows which parts of the face the 128 measurements are representing. All we know is that network outputs same 128 numbers for two different images of same person.

STEP 4: Finally, linear SVM classifier is used to recognize the face. The classifier is trained in such a way that it can take measurements from a test image and gives the closest match as output.
A Flask API interface accompanies our model to give the user a better experience. When the user opens application, they are asked to upload an image of the missing person. If a match is found, they will be provided with the image and details about the match. If match is not found, they will be asked if they want to register image as new entry into the database. If they wish to register, they will be asked to enter the details about the image as shown in

VI. RESULTS

Missing Child Identification System using Deep Learning and Multiclass SVM
In this paper author is describing concept to identify missing children by using Deep Learning and Multiclass SVM classifier and to implement this project author has used below modules

1) Using public dataset of missing children's called FGNET is used to train deep learning CNN prediction model. After training model whenever public upload any suspected child image then this model will check in trained model to detect whether this child is in missing database or not. This detected result will store in database and whenever want official persons will login and see that detection result.
2) SVM Multiclass classifier use to extract face features from images based on age and other facial features and then this detected face will input to CNN model to predict whether this face child exists in image database or not.

First, we used below dataset to train deep learning CNN model

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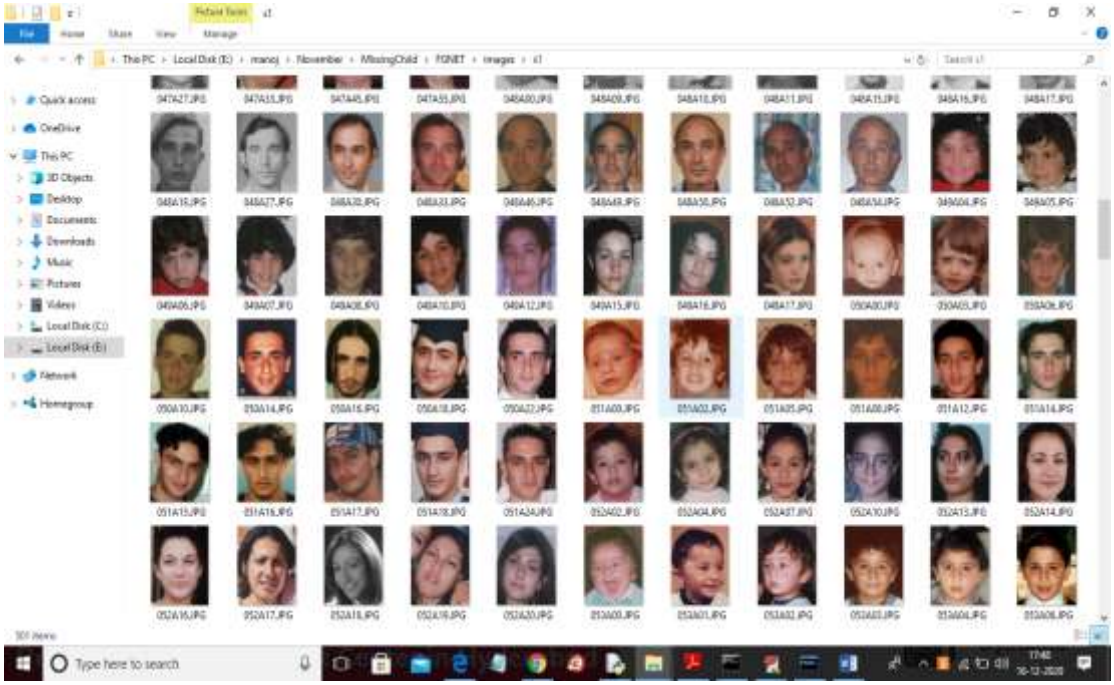

Figure 6.1 - Data set to train deep learning CNN model.

To run project follow below steps
1) First create database in MYSQL by copying content from 'DB.txt' file and paste in MYQL
2) Install python, DJANGO and MYSQL software
3) Create 'Python' folder in C directory and put 'MissingChilds' folder in it
4) start DJANGO server and run in browser to get first page

SCREEN SHOTS

Figure 6.2 - Add missing child details.

In above screen public can click on 'Public Upload Suspected Child' link to get below page and to add missing child details

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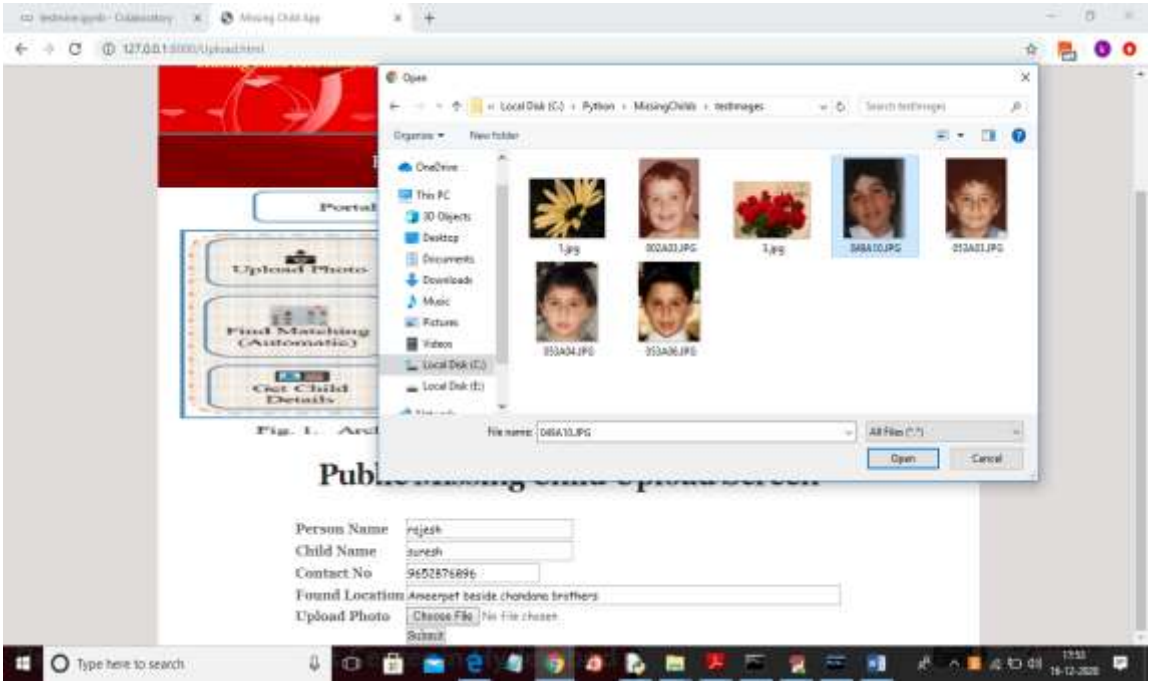

Figure 6.3 - Uploading of photo.

In above screen public will enter suspected child details and then upload photo and then click on 'Submit' button and to get below result

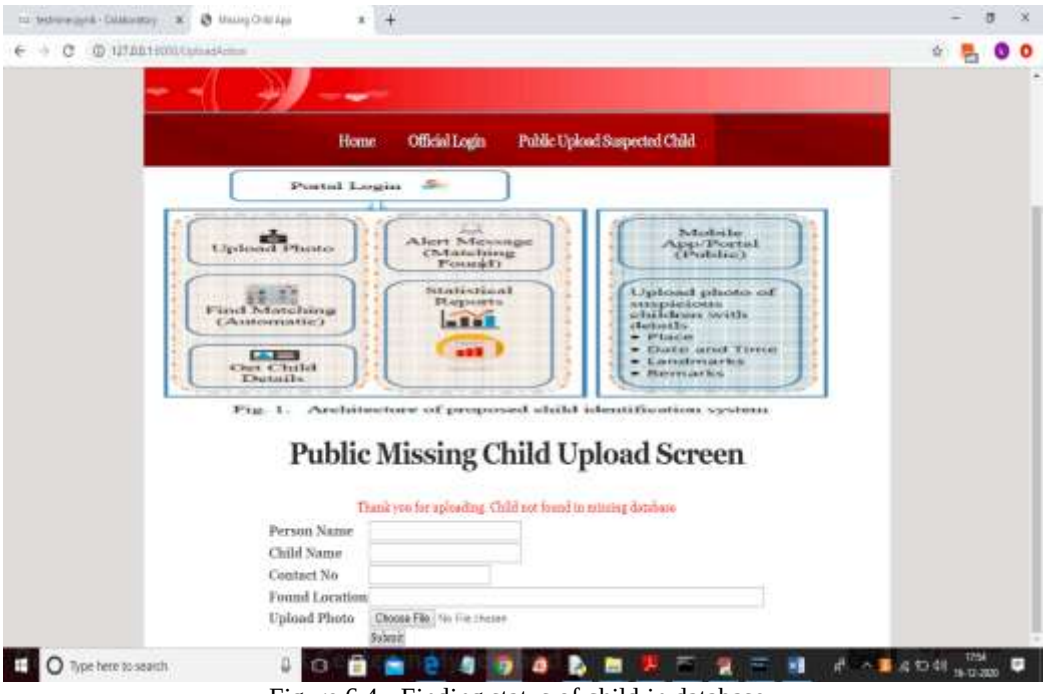

Figure 6.4 - Finding status of child in database.

In above screen we can see child not found in missing DB and we can try with other image

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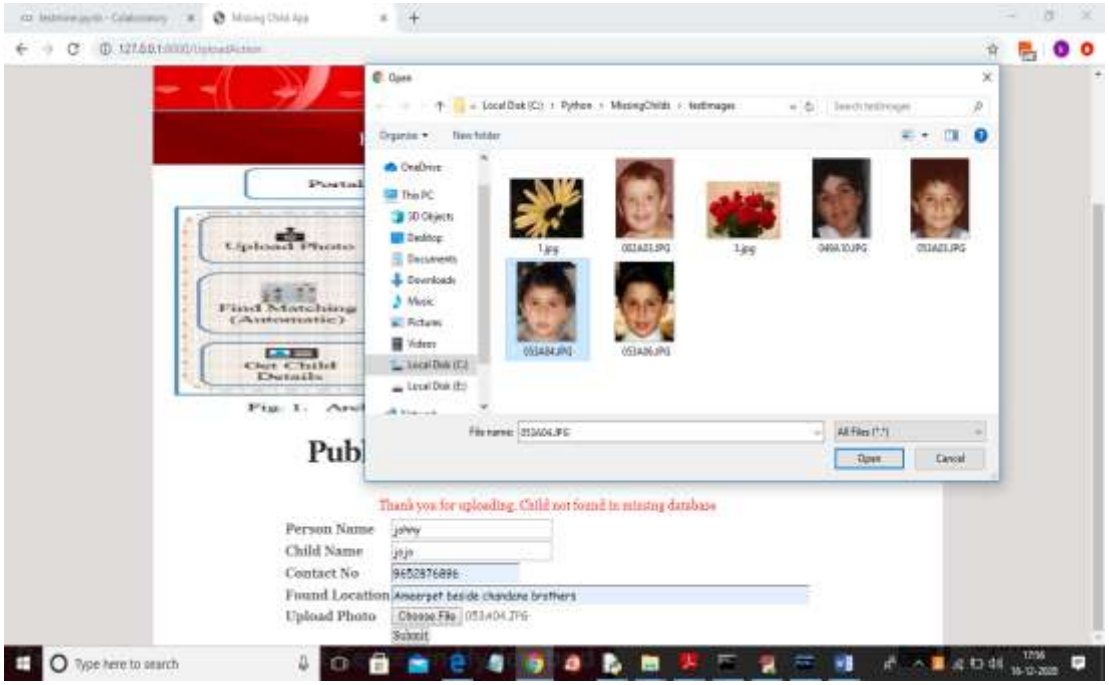

Figure 6.5 - Updated child results.

And below is the result for new above child details

Figure 6.6 - Entering into official login screen.

In above screen uploaded child found in database and now click on 'Official Login' link to get below login screen

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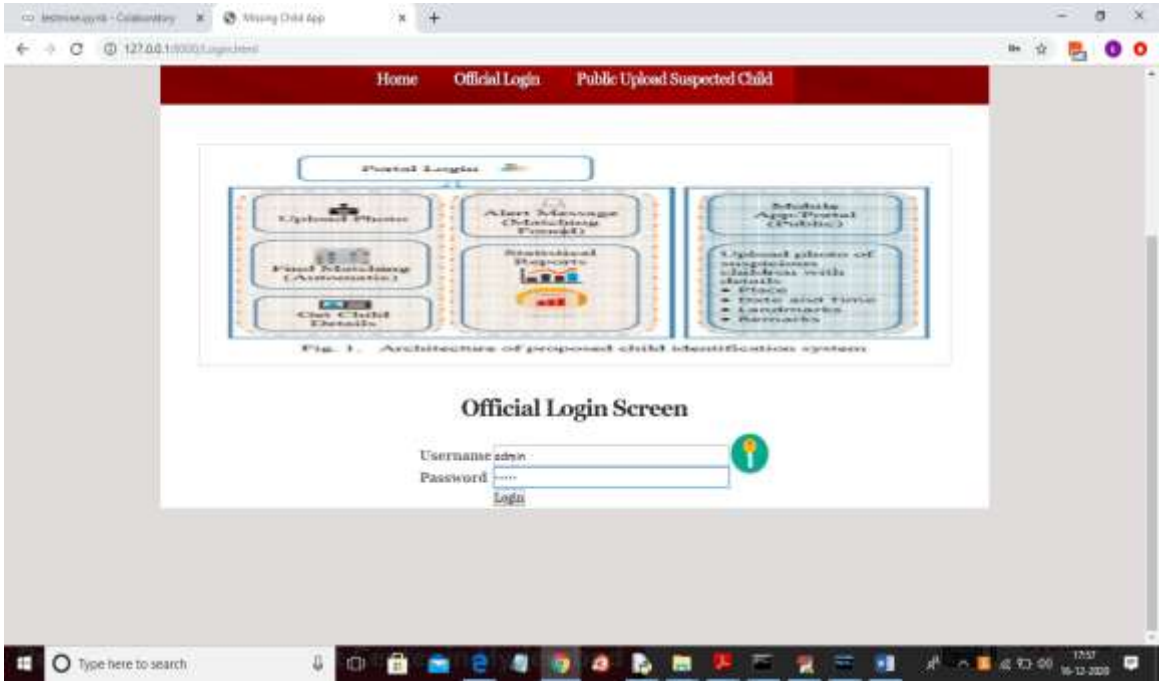

Figure 6.7 - Providing details of username and password.

In above screen admin can login by entering username and password as ‘admin’ and ‘admin’ and after clicking on ‘Login’ button will get below screen

Figure 6.8 - View Public Upload Missing Childs Status.

In above screen official can click on ‘View Public Upload Missing Childs Status’ link to view all uploads and its result done by public

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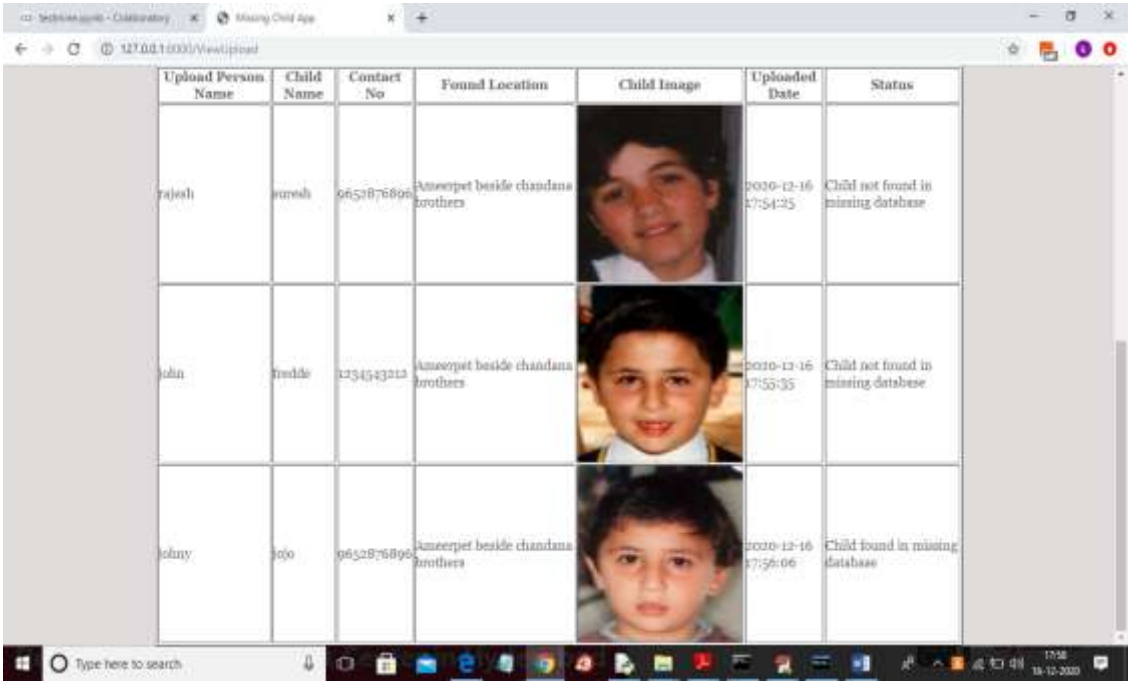

Figure 6.9 - Details are viewed and action is taken.

In above screen officials can see all details and then take action to find that child

VII. CONCLUSION

A missing child identification system is proposed, which combines the powerful CNN based deep learning approach for feature extraction and support vector machine classifier for classification of different child groups. This system is evaluated with the deep learning model which is trained with feature representations of children faces. By discarding the soft max of the VGG-Face model and extracting CNN image features to train a multi class SVM, it was possible to achieve superior performance. Performance of proposed system is tested using the photographs of children with different conditions, Noises and images at different ages. The classification achieved a higher accuracy of 99.41% which shows that the proposed methodology of face recognition could be used for reliable missing children identification.

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