ISSN No : 2454-4221 (Print)
ISSN No : 2454-423X (Online)
International Journal of Research in Advanced Computer Science Engineering
A Peer Reviewed Open Access International Journal
www.ijracse.com

SMART CC TV SURVEILLANCE

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Abstract

Have you ever come across a situation where you have to meet a person on a large campus consisting of so many blocks? You may face difficulty in finding a particular person. Sometimes it may cost you a lot of time than you think. Sometimes you may end up without even finding that person. Due to which you may get frustrated or exhausted or you may not have completed your desired work.

Smart CC Tv Surveillance System is a solution for such a problem. This system detects the person immediately whenever you want to meet that person. It uses the CC cameras within the campus to locate a particular person. This system uses python modules OpenCV for detecting faces, dlib for recognizing faces, and MySQL to store data that is coming from the system. We use a webpage to retrieve data from the database.

The software in the system takes CC tv video stream from CC cameras and processes it using OpenCV to detect faces from the video stream. The detected faces will be recognized using the dlib module. For each detected face, it will update the camera ID and location in the database corresponding to that detected face. So, whenever we want to locate a person, we can easily find out from the database using the webpage. This system can also be used for other applications other than this, we can use this system wherever we have large campuses, buildings, offices having CC cameras. Some examples are Vehicle Tracking and Employee Tracking etc.

Keywords: Smart CC Tv, Vehicle Tracking, Employee Tracking etc. Smart CC Tv

1. Introduction

Closed Circuit Television (CCTV) is currently used in daily basis for awide variety of purposes. The development of CCTV has transformed from a simple passive surveillance into an integrated intelligent control system. In this research, motion detection and facial recognition in CCTV video is used as the basis of decision making to produce automatic, effective and efficient integrated system. This CCTV video process provides three outputs, motion detection information, face detection information and face identification information. Accumulative Differences Images (ADI) method is used for motion detection, and Haar Classifiers Cascade method is used for face detection.

Cite this article as: J.Santoshi Kumari, R.Usha, Suresh.M , V.Chandra Krishna & J.Anusha,"Smart CC TV Surveillance", International Journal of Research in Advanced Computer Science Engineering, (IJRACSE), Volume 7 Issue 2, July 2021, Page 19-27.

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Feature extraction is done with Speeded-Up Robust Features (SURF) and Principal Component Analysis (PCA). Then, these features are trained by Counter-Propagation Network (CPN). Offline tests are performed on 45 CCTV video. The result shows 92.655% success rate on motion detection,76% success rate on face detection, and 60% success rate on face detection. It shows that this faces detection and identification through CCTV video have not been able to obtain optimal results. The motion detection process is ideal to be applied in real-time conditions. Yet if it's combined with face recognition process, it causes a significant time delay.CCTV has been used daily for many purposes such as crime investigation, traffic control, chemical process record, production control, and security surveillance. Public places such as offices, hospitals, shops, tourism resorts and also houses install CCTV for Security surveillance. In its development, the use of CCTV has transformed from passive surveillance into integrated intelligent surveillance system [1]. One of CCTV's drawbacks is the operator has to control record the whole time and identify faces manually. It also produces a large amount of data since the surveillance is done continuously [2]. Its drawback in less effective manual surveillance and its big need of memory can be reduced by setting an intelligent system which is integrated with CCTV in order to automatically produce surveillance system and data control. Office is one of the places where CCTV is used at most for surveillance system as the main purpose. The intelligent surveillance system using CCTV video data in offices can be installed for some purposes, for example motion surveillance, data storage control, access control, warning alarm control, and employee's attendance. In order to make CCTV data the basis of the decision, it is necessary to process CCTV data to provide various information. This research is done to process CCTV videos to gain information on motion, face detection, and face identification in places monitored by CCTV. Face detection process is an inseparable part of face recognition process. Face detection using Viola-Jones method is widely used because it produces high accuracy on face detection. One of the research using this method is research[3]. Research [4] also uses AdaBoost algorithm approach in face detection process to count the number of the faces in a classroom. Face recognition system [5] is built by implementing Speeded-Up Robust Features (SURF) for face pattern extraction and Support Vector Machine (SVM) for classification method. The result of this research shows that the system succeeds in dealing with variation in illumination, perspective, expression and scale. Research [6] and [7] uses face pattern recognition for attendance system application. Researh [6] develops attendance system by capturing students' images using the camera set in the front part of the classroom. In research [7], the camera is set on the classroom door to record their faces naturally. These research applies Viola-Jones method for detection and Eigenface for identification. Research [8] develops web-basis application for face detection at real time background used as employee's attendance. In face identification process, PCA is used for face pattern recognition and Haar Cascade method is used

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for face detection. This system has been tested and makes 68 % accuracy of face recognition. It is also used for security surveilance system. Research [9] builds access control system automatically. It uses Viola-Jones method for detection process, and PCA for face identification. Research [1] develops an intruder warning system for house safety. If an excessive movement is detected, system will detect faces with Eigenface algorithm. If it can't identify faces, it will send a warning and pictures to the house owner's mailbox. This face recognition test system makes 62% accuracy. This research uses motion detection and face recognition for surveilance system through CCTV. This process involves Accumulative Differences Images (ADI) method for movement detection, Cascade Classifiers (Haar Cascade Classifiers) for face detection, Speeded-Up Robust Features (SURF) algorithm and Principal Component Analysis (PCA) for feature extraction and reduction, and Counter-Propagation Network (CPN) algorithm for data training and testing in face identification proces. ADI method used by comparing image differences on some sequential frame can minimize error better than a method that can only count motions from two frame on each process. This method is preferred because of its simplicity that can save computation time.

2. SYSTEM ANALYSIS

Term system is derived from the Greek word 'systema' which means an organized relationship among functioning units or components. A system is an orderly grouping of interdependent components linked together according to a plan to achieve a specific objective.

2.1 Existing System

There is no such existing system. Manually, if person need to find or track another person, he need to search physically for him in the whole campus.

He need to go by walk, to each and every building present in the campus.

2.2 Proposed System

We represent the step wise working of our system which gives the brief idea about the modules used in the system.

- Step1- Browse the sample video from the hard disk or from any other storage device.
- Step2- Face detection will takes place in the video. Details about the detected face can be retrieved
- Step3- Face recognition can be done if the same video has that person or browsed video contain the person which was detected previously.
- Step4- Track the recognized person and identifying the last location of the person from the video details.

3. Requirement Specification

Functional Requirements

1. System has to detect a person's location.
2. System has to track a person
3. System can detect person's location along with time.

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Non – Functional Requirements

1. The software should work properly in offlinemode.
2. Suggestion should be shown in ascending orderaccording to the input ifavailable.
3. Input can be altered anytime.
4. As input is altered Suggestion should bechanged accordingly.

Software Requirements

1. Operating system: - Windows 10
2. Coding Language: - python 3.6
3. IDE: - Pycharm
4. Modules:- OpenCV and Tkinter

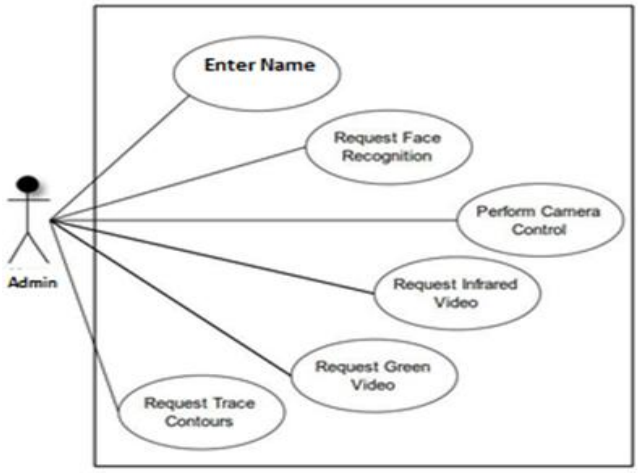
Hardware Requirements

1. Processor: - Core i5 or higher
2. Speed: - 2.1Ghz
3. RAM: - 8GB (min)
4. Hard Disk: - 200GB

4. System Design

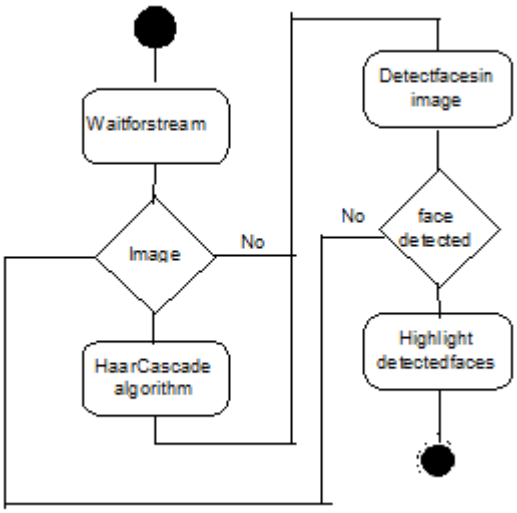
1. UML DIAGRAM

A UML diagram shows the unified visual presentation of the UML (Unified Modelling Language) system intending to let developers or business owners understand, analyse, and undertake the structure and behaviours of their system. So far, the UML diagram has become one of the most common business process modelling tools, which is also highly significant to the development of object-oriented software.



4. ACTIVITY DIARAM

An **activity diagram** is used to model a large **activity**'s sequential work flow by focusing on action sequences and respective action initiating conditions. The state of an **activity** relates to the performance of each workflow step.



Activity diagram

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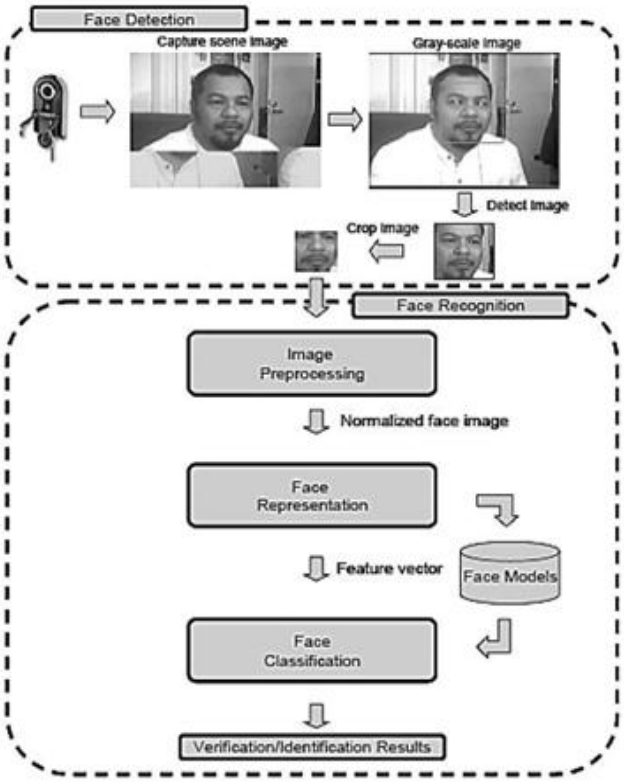

Face verification process

4.1 Language Specification

PYTHON

An Introduction to Python

Python is a popular object-oriented programming language having the capabilities of high-level programming language. It's easy to learn syntax and portability capability makes it popular these days. The followings facts give us the introduction to Python −

- Python was developed by Guido van Rossum at Sichting Mathematics Centrum in the Netherlands.
- It was written as the successor of programming language named 'ABC'.

  It's first version was released in 1991.
- The name Python was picked by Guido van Rossum from a TV show named Monty Python's Flying Circus.
- It is an open-source programming language which means that we can freely download it and use it to develop programs. It can be downloaded from www.python.org..
- Python programming language is having the features of Java and C both. It is having the elegant 'C' code and on the other hand, it is having classes and objects like Java for object-oriented programming.
- It is an interpreted language, which means the source code of Python program would be first converted into bytecode and then executed by Python virtual machine.

5. Methodology

The first step is by acquiring video images from CCTV. Those images will be used for motion detection process. If a motion is detected, the information of time stamp and images with detected motion will be stored. Then, the motion value will be compared to face detection threshold. If the motion exceeds it, the face recognition process will be committed. Images with detected motion will be the input of face detection process. This process will decide if the face object exists. If it exists, detection information will be recorded and continued to face identification process.

In face identification process, the face features is tested by using the value gained

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from data training and matched with data basis. The data training process is done before testing the face identification by using the same image processing. Face identification process produces decision and record the identity of the identified face.

The collected data in this research is in the form of video file and was taken in PT. Mitranet Software Online Purwoker to for five days. The videos were taken indoor by CCTV at 07:45–08:45 IWST, 12:00–13:00 IWST, and 15:15–16:15 IWST. The CCTV video resolution is 960 x 720 and 640 x 480 with 10 fps frame per second. There are 90 video fileswith10 minute duration each. Of those 90files, 45 videos are trained and there is tested.

6. **Development Coding**

CREATE_CLASSIFIER.PY

```python
import numpy as np
from PIL import Image
import os, cv2

# Method to train custom classifier to recognize face
def train_classifer(name):
    # Read all the images in custom data-set
    path = os.path.join(os.getcwd()+"/data/"+name+"/")

    faces = []
    ids = []
    labels = []
    pictures = {}

    # Store images in a numpy format and ids of the user on the same index in imageNp and id lists

    for root,dirs,files in os.walk(path):
            pictures = files

    for pic in pictures :

            imgpath = path+pic
            img = Image.open(imgpath).convert('L')
            imageNp = np.array(img, 'uint8')
            id = int(pic.split(name)[0])
            #names[name].append(id)
            faces.append(imageNp)
            ids.append(id)

    ids = np.array(ids)

    #Train and save classifier
    clf = cv2.face.LBPHFaceRecognizer_create()
    clf.train(faces, ids)
    clf.write("./data/classifiers/"+name+"_classifier.xml")
```

```python
import cv2
from time import sleep
from PIL import Image
from datetime import date
from datetime import datetime
from tkinter import messagebox

def main_app(name):

        face_cascade = cv2.CascadeClassifier('./data/haarcascade_frontalface_default.xml')
        #recognizer = cv2.face.LBPHFaceRecognizer_create()
        recognizer = cv2.face.LBPHFaceRecognizer_create()
        recognizer.read(f"./data/classifiers/{name}_classifier.xml")
        cap = cv2.VideoCapture(0)
        pred = 0
        date = list()
        while True:
            ret, frame = cap.read()
            #default_img = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
            gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
            faces = face_cascade.detectMultiScale(gray,1.3,5)
            #frame = cv2.resize(frame,(700,800))

            for (x,y,w,h) in faces:
                roi_gray = gray[y:y+h,x:x+w]
                id,confidence = recognizer.predict(roi_gray)
                confidence = 100 - int(confidence)
                pred = 0
                if confidence > 50:
                    #if u want to print confidence level
                            #confidence = 100 - int(confidence)
                            pred += +1
                            text = name.upper()
                            #print("CAMERA 1")-
                            now = datetime.now()
                            dt_str = now.strftime("%d/%m/%Y %H:%M:%S")
                            print(dt_str)
                            date.insert(0,dt_str)
                            font = cv2.FONT_HERSHEY_PLAIN
                            frame = cv2.rectangle(frame, (x, y), (x + w, y + h), (0, 255, 0), 2)
                            frame = cv2.putText(frame, text, (x, y-4), font, 1, (0, 255, 0), 1, cv2.LINE_AA)
```

```python
else:
                            pred += -1
                            text = "UnknownFace"
                            font = cv2.FONT_HERSHEY_PLAIN
                            frame = cv2.rectangle(frame, (x, y), (x + w, y + h), (0, 0, 255), 2)
                            frame = cv2.putText(frame, text, (x, y-4), font, 1, (0, 0,255), 1, cv2.LINE_AA)

            cv2.imshow("image", frame)


            if cv2.waitKey(20) & 0xFF == ord('q'):
                print(pred)
                if pred > 0 :
                    dim =(124,124)
                    img = cv2.imread(f".\\data\\{name}\\{pred}{name}.jpg", cv2.IMREAD_UNCHANGED)
                    resized = cv2.resize(img, dim, interpolation = cv2.INTER_AREA)
                    cv2.imwrite(f".\\data\\{name}\\50{name}.jpg", resized)
                    Image1 = Image.open(f".\\2.png")

                    # make a copy the image so that the
                    # original image does not get affected
                    Image1copy = Image1.copy()
                    Image2 = Image.open(f".\\data\\{name}\\50{name}.jpg")
                    Image2copy = Image2.copy()

                    # paste image giving dimensions
                    Image1copy.paste(Image2copy, (195, 114))

                    # save the image
                    Image1copy.save("end.png")
                    frame = cv2.imread("end.png", 1)

                   # cv2.imshow("Result",frame)
                    #cv2.waitKey(5000)
                break
        messagebox.showinfo("CAMERA" + " TIMESTAMP", "CAMERA : CAMERA 1 " + "          TIMESTAMP : "+date[0])
        cap.release()
        cv2.destroyAllWindows()
```

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7. **System Testing**

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of tests. Each test type addresses a specific testing requirement.

7.1 TYPES OF TESTS

Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results

Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:
Valid Input: identified classes of valid input must be accepted.
Invalid Input: identified classes of invalid input must be rejected.
Functions: identified functions must be exercised.
Output: identified classes of application outputs must be exercised.
Systems/Procedures: interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are

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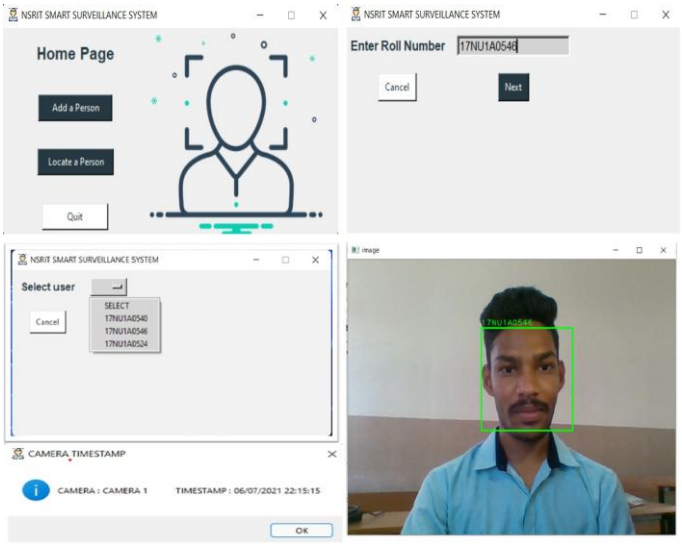
identified and the effective value of current tests is determined.

8. Result Output Screens



9. Conclusion

The computational models, which were implemented in this project, were chosen after extensive research, and the successful testing results confirm that the choices made by the researcher were reliable. The system with manual face detection and automatic face recognition did not have recognition accuracy over 90%, due to the limited number of eigen faces that were used for the PCA transform. This system was tested under very robust conditions in this experimental study and it is envisaged that real world performance will be far more accurate. The fully automated frontal view face detection system displayed virtually perfect accuracy and in the researcher's opinion further work need no tbe conducted in this area. And in this system when we enter the name of the person it check from the video of different cameras and return the last location of the person I n the video through which we can track the person form cctv camera Furthermore, many of the test subjects did not present an expressionless, frontal view to the system. They would probably bemorecompliantwhena6'5"policemanistakingtheirmugshot! In mugshot matching applications, perfect recognition accuracy or an exact match is nota requirement. If a face recognition system can reduce the number of images that a human operator has to search through for a match from 10000 to even a 100, it would be of incredible practical use in law enforcement.

The automate dvision systems implemented in this thesis did not even approach the performance, nor were they as robust as a human's innate face recognition system. However, they give an insight into what the future may hold in computer vision.

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