

Abstract

This work addresses the problem of monitoring a baby at home using a smart phone. Parents are often busy and not at home. As such, knowing the real-time behaviour of their babies is very important to them. To address this issue, a smart home-monitoring system was created to help parents take care of their babies at home remotely. By setting up video cameras at home, mobile phones can receive the video signals. The system provides a novel baby-care function such that the mobile phone alarms when the baby enters some dangerous spaces such as the kitchen, the balcony, the windows, etc. This system involves computer vision technologies such as face detection and recognition, unsafe area alarm and distance monitoring. Users can mark the safe area and unsafe area interactively. Our prototype demonstrated the feasibility of the system.

Introduction

In this fast-paced time, busy young parents need to work on the daytime, and sometimes they have to go on a business trip, so they have no time to take good care of their babies. But they hope to see their babies anytime and anywhere, to know what their babies are doing and whether their babies are safe and happy or not. So we need a device to help people take good care of babies.

This is what my project is about —— a project called smart home baby monitoring system. The system helps the users control the camera at home and see their babies like the picture (see Figure 1 for details) shows.



Figure 1. The camera connects to monitoring the system of baby.

These three technologies are applied into this system:

- 1.(Human) Face detection and recognition
- 2.Unsafe area alarm
- 3.Distance Monitoring

The system uses the Cascade Classifier class to detect objects in a video stream and Eigenfaces method to recognize faces. Face perception can locate the positions of the babies by scanning and recognizing their faces. System checks whether the baby is safe or not through whether the midpoint of the screenage of face is in the unsafe area (such as kitchens and bathrooms) or not. It will send out alarms if the midpoint is in the unsafe area as the baby is at risk. Snapshots will be captured and the relative data will be transferred to other portable computers.

Materials and Methods

1) Face Detection and face recognition

- The project uses Cascade Classifier and Eigenfaces [5] which belong to OpenCV to implement face detection and face recognition.
- Use the CascadeClassifier class to detect objects [6][7] in a video stream. Particularly, we will use the functions:
 - Load an .xml classifier file. It can be either a Haar or a LBP (local binary pattern) classifier.
 - Use detectMultiScale to perform the detection.[8]

The project uses Eigenfaces method to recognize the faces.

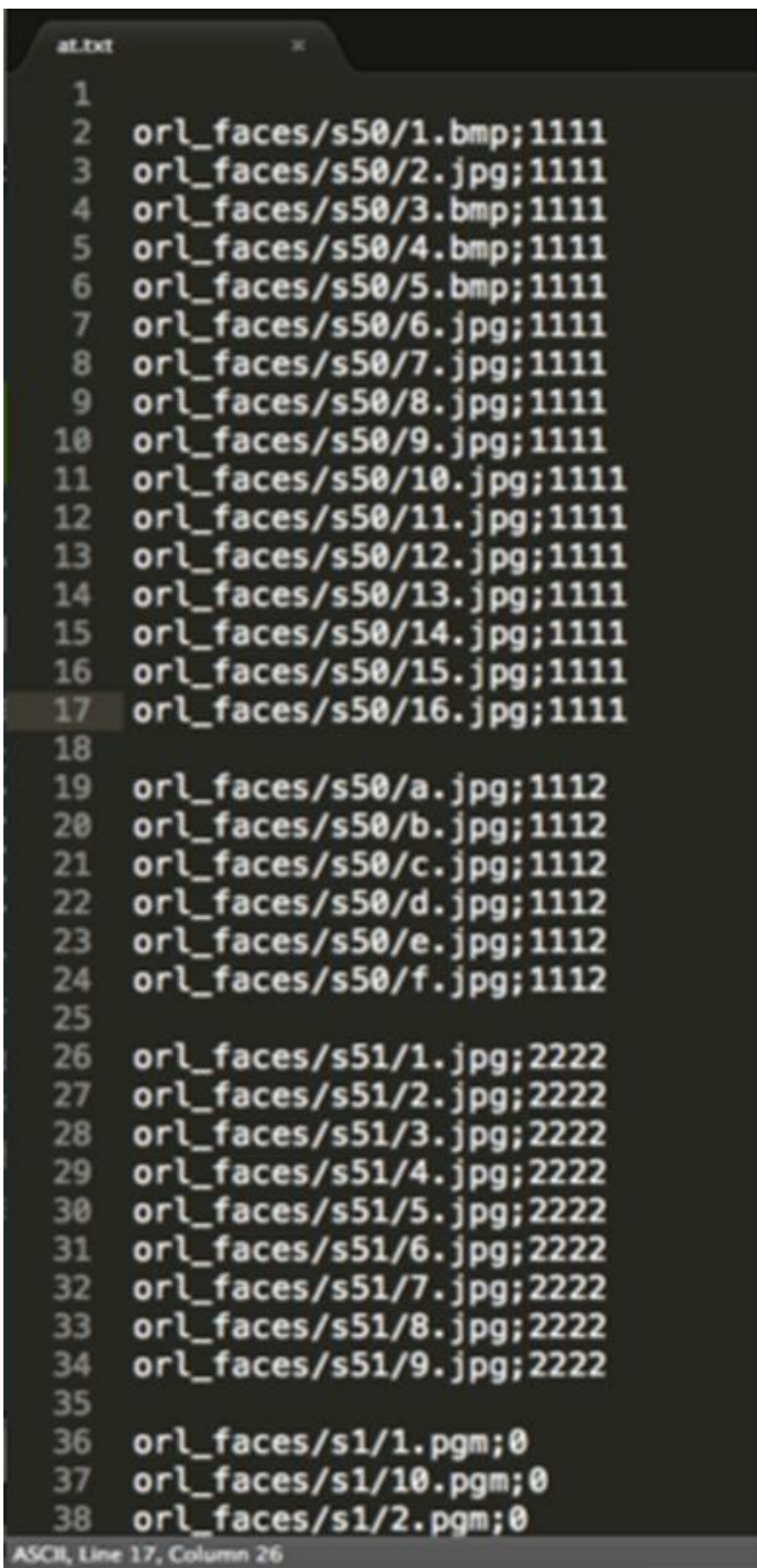
To fulfill the recognition of a face, we need a face database [10].

(see Figure 3, Figure 4 for details).



Figure 3 shows up, down, left and right through the screen.

Figure 4 this is a face database. The content of the file is like that path to file, colon and picture id.



2) Unsafe area alarm

1. Display a scene to mark the safe area and unsafe area.
2. Face perception checks where the baby is.
3. Computer checks whether the baby is safe or not. It will send out alarm if the baby is at risk.



Figure 5 shows safe, warning and unsafe result.



Figure 6 shows unsafe area.

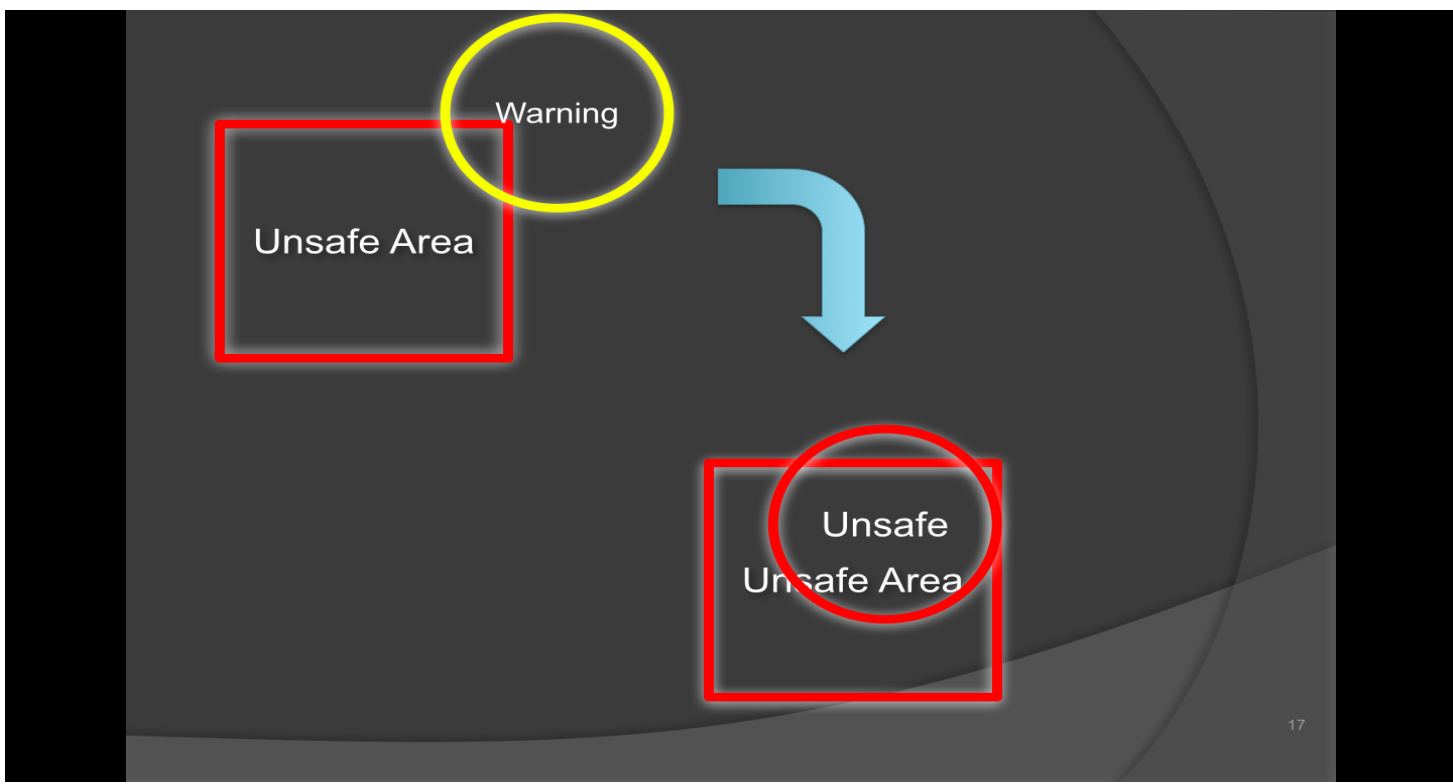


Figure 7 shows from warning area to unsafe area.



Figure 8 shows a parallelogram unsafe area.

3) Distance Monitoring

1. Capture the screen
2. Transform Image Data to Byte Data
3. Transfer the data
4. Other computer receive the data and show

At first, we screen shot the desktop as Buffered Image Data Type, and then transform the Buffered Image to ByteArrayOutputStream and to Byte Data Type. Send the Byte Data into network stream, the other computers can get the data stream, and they transform the data stream to image data type.

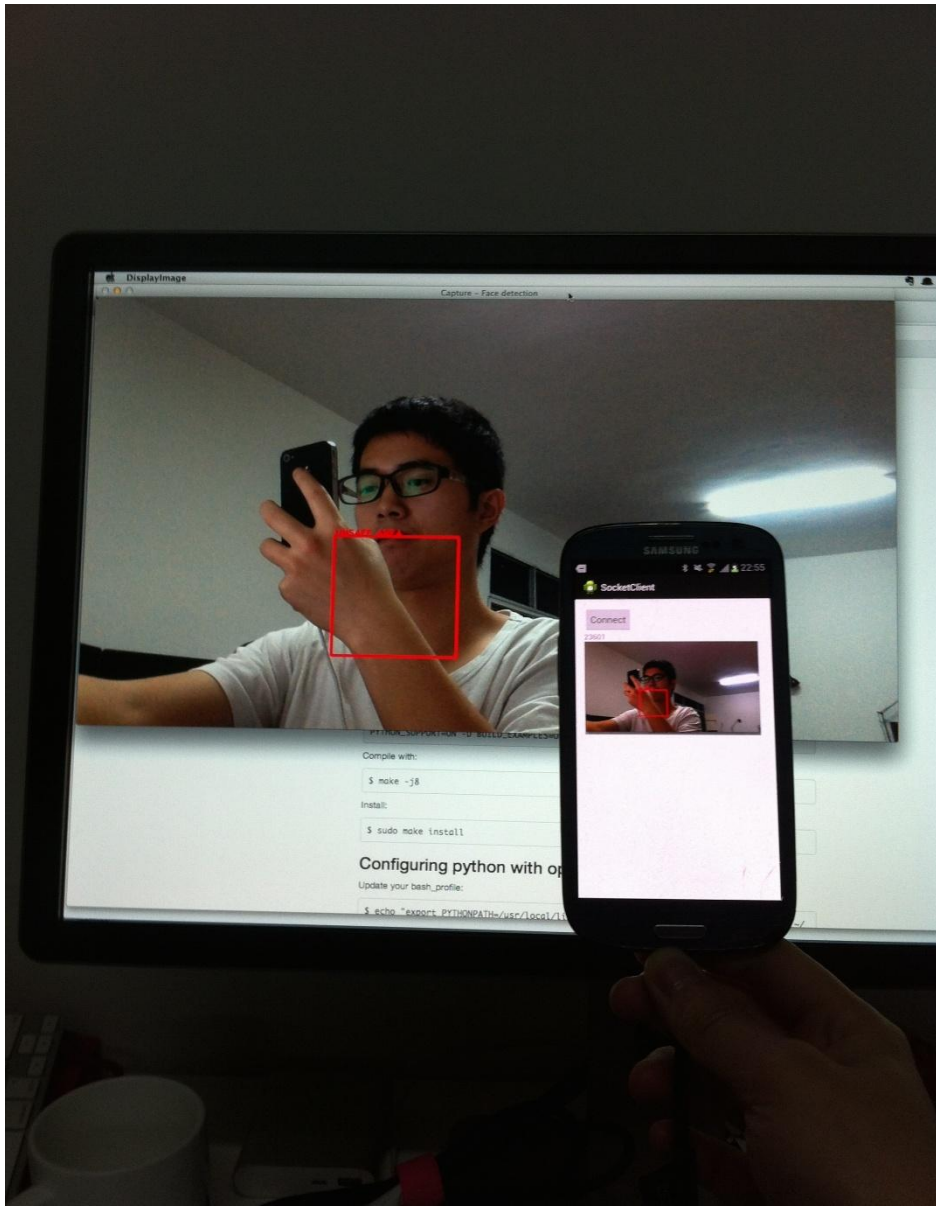


Figure 9 Example: one computer gets the capture, and the smart phone gets the same one.

4) Implementation

1. IP camera is a general camera which people can buy anywhere.
2. The code will be written as java code.



Figure 10 is about finding out a face in the picture, the left is before and the right is after.



Figure 11 is about finding out faces in the picture, the left is before and the right is after.



Figure 12 is about finding out faces in the picture if the picture lack of clarity, the left is before and the right is after

Discussion

- 1)The data transmits from PC to other PC without delay. Data transmission delay is inevitable. Video data must be smaller enough to meet the limit requests of bandwidth before transmission.
- 2)Face perception distinguishes baby and adult. The system can recognize baby and adult using capture, base as portrait and according to the height.
- 3)There are two features which will be developed in the future.
 - a)Firstly, the system should detect babies using better method to improve recognition rate such as using RFID. It needs to detect living beings which they are human beings and they are infants. The system in this project just detects a baby as detecting a face.
 - b)Secondly, the system should use the smart phone client instead of using the computer client. In China, there are some problems of smart phones like the low speed and limited amount of web traffic. Distance Monitoring of the system needs a great network environment, it needs WI-FI which the speed of web traffic is more than 200kb/s. So the system prefer using computer instead of using smart phone in this project. The project aims to set a smart house system for parents in order to monitor babies' behaviors at home.

Conclusion

Smart Home Baby Monitoring System will greatly reduce our tedious work, facilitate our lives and also make our babies more comfortable. Time becomes more valuable, so using intelligent devices sharing our workload is a priority. The system is derived from facilitating life.

Parents are most concerned about the safety of the babies. Though this system, parents can know the babies' security situation no matter where parents are. Safe and comfortable is the ultimate goal of the system.

OpenCV library sets its focus on the latest computer vision algorithms to detect and recognize faces. The system basing on face detection sent out alarm when the midpoint of the face enters the unsafe area. The circle color is changed through the faces state. The Image Data though transforming and transferring is displayed from one computer the other computer.

References

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