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A Study On Facial Analysis Techniques For Developing School Security System Using A Face Recognition System

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Abstract

The objective of this research was to study the face analysis technique for developing school security system using a Face Recognition System and to develop the security system using a Face Recognition System. This research has research steps which were documents and research related to Face Analysis and Face Recognition, the selection of image processing by using LBP cascade and Haar cascade techniques to analyze data of faces in which to develop security systems and to implement the techniques obtained in development of a school security system using Face Recognition System. The results of this research were that from the study of the face analysis technique between the LBP cascade and Haar cascade cleaning procedure, which the researcher chose to use Haar cascade because it was performed with 87.12% and then using the LBP cascade technique with accuracy at 76.92% and using Haar cascade technique in the development of school security system using the system which appropriated to Face Recognition System.

Keywords: Security System, Early Childhood Students, Face Recognition, Internet of Things (IoTs)

INTRODUCTION
Schools that provide early childhood education or kindergarten are very important to children as they have to spend 6-8 hours a day on their own influencing on the minds, interests and ideals in every child's school and work life.In addition, the school is an institution that will foster children to have good health, intelligence, and safe behavior that can lead a happy life (Wattanaburanon, 1996). Therefore, when a parent or guardian of a child has assigned an obligation to the school to provide education, training and temporary care for the child on behalf of the school administrator, the teacher and personnel within the school therefore cannot deny the responsibility of caring and managing the welfare of children (Sarayuthpitak. 1998).A study of parents' needs for the welfare of pre-kindergarten students found that parents of pre-kindergarten children had high demands for safety because their children were very young and unable to support themselves in this manner of children in this age. Therefore, it is something parents are particularly concerned about the safety of children at this age (Lamphun, 1999) consistent with Unakul (1997) claimed that, the aim of the safety service is to detect, prevent and correct any situation that may cause harm to humans in early childhood education institutions generally provided safety services have important objectives, such as preventing harm that may or may occur to children and school personnel, and securing child

personnel while in school while traveling between home and school and create confidence and peace of mind for parents, teachers and those involved in child care, etc.Today's Information and Communication Technology is constantly changing and researchers have applied those technologies to manage the classroom, one of them is Face Recognition or Face Detection in which is the process of finding a person's face from an image or video and then processing the resulting face imageso that the image of the face can be detected. There are many different Face Detection algorithms and methods used today in which a good Face Detection algorithm helps to recognize faces more accurately and quickly (Weluwanathon, 2011). The use of Face Detection is becoming popular in many countries to be used to monitor students' learning interests, including the United States, China, Japan, India. In addition to examining learning interests, the data can also be used to analyze teaching and learning management and to improve and improve teaching and learning management for learners to learn more effectively (Rosengrant, 2012). Facial Recognition Technology is a part of biometric measurement with a device or software that works similar to a fingerprint scanner, eye and iris scanning systems use computer systems and Facial Recognition software to identify or verify a person by detecting their appearance faces to compare with large databases (Kusonkrong, 2016). There are currently many Face Detection methods in which a good algorithm helps in recognizing faces with greater accuracy and speed (Paul Viola, & Michael J. Jones. 2001).From the foregoing, it was found that at present, schools and parents need to maintain a high level of security in schools for early childhood because students are unable to take care of themselves. The researcher is aware of such problems. Including today, technology has become more involved in our daily lives. In many fields, the researchers therefore used the technology that is currently available, namely Face Recognition, to develop as a model for security in schools by using Facial Recognition System for the benefit of school students including parents by studying techniques that will be used to develop a security system to be accurate and fast in order to apply the techniques that have been developed to develop a security system within the school.

METHOD

This research was experimental research which to study Face Detection techniques for the development of school security systems. The researcher followed the 6 steps of the PDLC cycle as follows:

1. Requirement Analysis and Feasibility Study

The researcher studied and analyzed the concepts and theory of school safety. from papers, articles and related research and study techniques that can be used in Face Detection to improve school security.

2. Steps to plan the solution (Algorithm Design)

The researcher designed a flow chart that is used to show the workflow of a security system and a flow chart shows the process of training the login information which uses symbolic images to convey meaning each step of the work and used arrows to indicate the direction of travel of the work sequence. This allowed you to know the steps and sequence of the program correctly along with explaining the working process.

     Explain the algorithm showing the process of training the login information.
     1. Start the program.

2. Open the program will provide student code information

3. The system will prompt to fill in the name - last name.

4. The program will open the camera to detect face data.

5. Detect human faces that the camera sees.

6. Face Detection

      6.1 If a face is found, it will proceed to step 7, which is to save the student ID, name-surname and face on the database.

      6.2 If no face is found, it will go back to step 4 to detect face data.

7. Save the student ID, name-surname and face of 100 images on the database.

8. The system will use the facial image to train the computer to learn and recognize faces.

9. Exit the program.

Describes algorithms showing the sequence of workflows of a security system.

1. Start the program.

2. Open the program and the camera will open.

3. Detect human faces that the camera sees.

4. Face Detection

      4.1 If a face is found, it will proceed to step 5, which is to compare the data in the image database.

      4.2 If no face is found, it will go back to step 2 to detect face data.

5. Compare the data in the image database.

      5.1 If the face data is found in the database, it will proceed to step 6, which is to specify who the face is. Face Recognition

      5.2 If no face data is found in the database, go back to step 1 to start over.

6. Identify who the face is. Face Recognition

7. Save student ID and name-surname data into Microsoft Excel file.

8. Show name and time of attendance

9. Exit the program.

3. Programming procedure (Program Coding)

In the process of programming (Program Coding) to develop school security systems using Facial Recognition Systems, Python will be developed primarily. which has prepared various equipment and programs for development as follows.

    3.1 Equipment or Hardware

        3.1.1 Computer for image processing which consists of

            3.1.1.1 CPU I5 10400

            3.1.1.2 Mainboard

            3.1.1.3 RAM DDR4 Bus2666

            3.1.1.4 Power Supply 650W

            3.1.1.5 Hard disk or Solid state drive 500GB

            3.1.1.6 Graphic card GTX1060 6GB

            3.1.1.7 Mouse and Keyboard

        3.1.2 Webcam Oker is a device used for receiving image data.

        3.1.3 Computer display used for displaying system information.

3.2 Program or Software

3.2.1 Visual Studio Code is used for programming in Python.

3.2.2 Python IDE for system development

3.2.3 Keras is a deep learning framework. It is a deep-learning library of python language that enables the train method to run programs on both CPU and GPU.

3.2.4 TensorFlow is a library used in machine learning development.

3.2.5 Pandas is a library in Python. Load a data file such as CSV into it and we will get the data in a tabular form. Split data by rows and columns or like Excel

3.2.6 NumPy is a Python extension module with functions. about mathematics and calculations

3.2.7 OpenCV is an open-source language software. Python for image manipulation

3.3 Facial Analysis Techniques

3.3.1 Haar Cascades technique

It is a technique with high Face Detection speed and accuracy compared to traditional Face Detection techniques. by the concept of this technique is to check for a group of pixels on an image that is close to the Harr-like feature to determine whether the pixel group is a human face or not.

3.3.2 Local Binary Pattern (LBP) Technique

Local Binary Pattern (LBP) is a local binary pattern identification technique that is a technique for distinguishing effect patterns in images by using the calculated LBP value in each pixel to make a histogram for facial feature identification.

The researcher chose 3.3.1 Haar Cascades because the Haar Cascades technique has the highest accuracy because it has the advantage that it is able to withstand changes in the level of light in the image regardless of how dark or bright the image is. If the source of light is the same then we can create vectors with the same characteristics.

4. Program Testing and Debugging

The researcher prepared a letter requesting assistance to the experts to examine the research tools and implementing a security system in schools using Facial Recognition Systems to use within educational institutions with the following steps:

4.1 Collect the face data of the students and parents of the sample group.

4.2 Bring the collected face data to teach the computer to learn

4.3 Bring the system to test for system errors

4.4 Various bug fixes

4.5 Put the system to practice

5. Process of writing supporting documents (Documentation)

5.1 The researcher provided a video explaining the steps for using the security system.

5.2 Administrator's Guide

5.3 User's Guide

6. Program maintenance

The researcher will update the student's face data to be current so that the security system learns to always recognize the faces of students to reduce Face Recognition errors.

Research Tools
Face Recognition System

Data Collection
1. The researcher contacted the director of Nakhon Sawan Kindergarten School to inform details about the research and requesting assistance from the director to arrange a meeting for parents at the primary level to allow the researcher to explain the research in its entirety to the parents as well as to distribute the consent form to the parents.
2. When parents agree to join the project,the researcher will arrange a sample group to record the facial data and personal information such as name-surname and student ID.

Study Period
1. The duration of the research project is 5 months.
2. Starting from August 2021 until December 2021
3. Duration of data collection 4 months
4. Starting from September 2021 until December 2021

RESULTS
This research, the researchers studied Face Detection techniques to develop a school security system using facial recognition.

The objectives were
1. To study the technique of Facial Analysis to develop a security system.
2. To develop a school security system using Facial Recognition Systems. The researcher will present the research results according to the research objectives into 2 parts, respectively, as follows:

Part 1 examines Facial Analysis techniques in developing a security system.

Table 1: Student Face Detection accuracy test results using Haar Cascade as Facial Analysis technique.

Technique	Total Image	DetectableImage	UndetectableImage
Face Detection accuracy using Haar Cascades technique	2,500	2,178	322
$\bar{x}$	100.00	87.12	11.60

From Table 1, the test results of Face Detection accuracy using Haar Cascades technique showed that the faces detected were straight faces, no obstruction in the right distance not too far of the 2,500 total images, the average face-detection image is average accounted for 87.12Percent, and the average face was undetectable accounted for 11.60Percent.

Table 2: Student face detection accuracy test results using the LBP cascade facial analysis technique.

Technique	Total Image	DetectableImage	UndetectableImage
Face Detection accuracy using LBP	2,500	1,923	577
$\bar{x}$	100.00	76.92	23.08

From Table 2, the results of the face detection accuracy test using the LBP cascade technique showed that the faces detected were straight faces. No obstruction, just the right distance, not too far from a total of 2,500 shots, face-detecting average 76.92 Percent, and the average image was undetectable to faces. accounted for 23.08 Percent

Table 3: Face detection speed test results using Haar Cascades and LBP Cascade techniques.

Techniques	Face Detection Speed	Percentage Speed
Haar Cascades	92.26	92.26
LBP Cascade	92.80	92.80

From Table 3, the results of the processing speed test sensitivity of Face Detection using Haar Cascades and LBP Cascades showed that Haar Cascades had a speed of 92.26 Percent, which was lower than that of LBP Cascade, with a speed of 92.80 Percent.

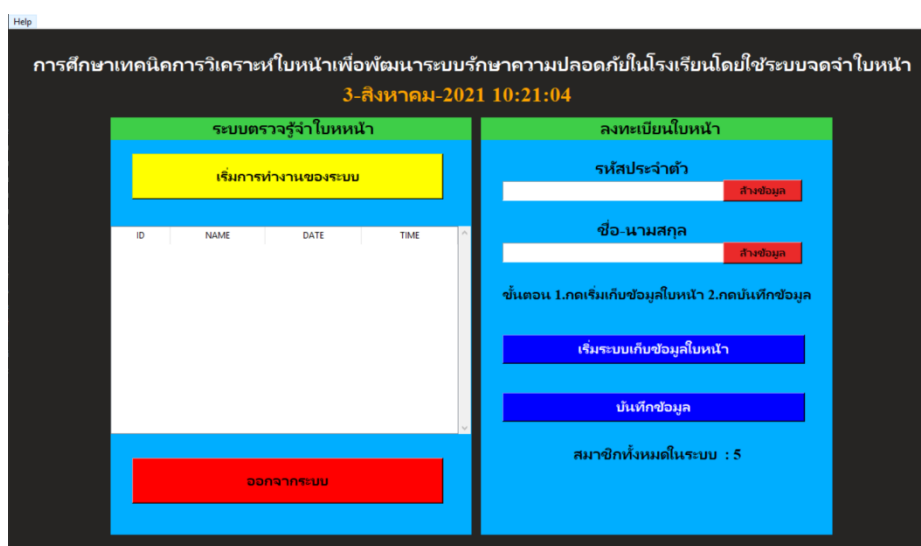Part 2 Develop a school security system using Facial Recognition

Figure 1. School Security System Using Facial Recognition System

From Figure 1, it was found that the researcher divided the operation of the school security system using the Facial Recognition Systems into 2 parts: the first part was the face registration part, the researcher created a text box for filling out information User ID and Username, when completed and press the start button to collect face data. The system will open the camera window to record the face data, when it is done, press the record button, the system will train the data to the computer and the second part of the face recognition system will have a yellow button to start the

face recognition system and there is a section for reporting detected data and the last section is a red button to log out.

CONCLUSSION

1. The results of a study of Facial Analysis techniques in the development of security systems found that the Haar Cascade technique was more accurate than the LBP cascade technique because it examined the pixel group on the image that was close to Harr-. like feature to determine whether a group of pixels is a person's face or not. This corresponds to the research of (Shetty, 2021) research on Facial Recognition using Haar Cascade and LBP Classifiers. It was found that using Haar Cascade technique was more effective in analyzing and detecting faces with accuracy. However, it takes longer to process the data than the LBP technique, which is consistent with the results of this research. That's why the researcher chose the Haar Cascade technique to develop a school security system, because it is more accurate, although it can process more slowly but the system to be built want to be accurate if there is a high processing speed but no accuracy, it is not suitable for use in school security. Since early childhood children need more safety than other age groups because they are unable to take care of themselves, the researchers therefore chose the Haar Cascade Facial Analysis technique to be used to develop school security systems using Facial Recognition Systems most efficient.

2. The results of the development of security systems in schools using Facial Recognition Systems found that if the Haar Cascade technique was used in the development of a security system, it will help the security system to be more accurate and efficient. and can be applied in other fields to bring more benefits It is a system developed using Python with OpenCV, a language that developers can easily learn and use. It is not a language that is too difficult to learn and can also improve other areas of work.

Schools are institutions that foster healthy children, intelligent, and have safe behaviors that can lead a happy life (Wattanaburanon, 1996). Therefore, when parents or guardians of a child have assigned a temporary obligation to the school to provide education, training and care for the child on their behalf school administrators, teachers, and other personnel within the school therefore cannot deny their responsibility to care and manage various matters for the best welfare of children. Implementing a school security system using Haar Cascade's facial recognition technique in schools will provide a more accurate and efficient security system andhelping to make the school more secure. School safety will increase the welfare of students because school is a place where safety is a must, parents will have the trust in taking care of their children student's school. This system also allows schools to collect student attendance data and, finally, is a model of school security technology that other schools can apply for the benefit of students, parents, teachers, and institutions study.

This paper presents research showing that the LBP Cascade technique is accurate in detecting faces. It was found that the LBP Cascade was 92.80 Percent less accurate than the Haar cascade technique, which was 89.80 percent faster than the Haar Cascade technique in computing accounted for 92.26 Percent. For the study, the researchers chose the Haar Cascade technique which is more accurate than the LBP Cascade technique because it is suitable for the development of school security systems because in the development of a security system, accuracy is primarily required and for the benefit of students, parents, teachers, and educational institutions. In addition, such a system can be used as a model for other educational institutions to develop according to the context of the educational institution and in order to use the technology for maximum benefit.As a

result of applying Haar Cascade Facial Analysis technique to develop school security system using Facial Recognition System, is a system that is used to secure the school attendance and homecoming of early childhood students will be recorded. Attendance and return home of students will be also recorded. The information can be checked by dividing the work into 2 parts: the face registration part and the use of the security system.

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