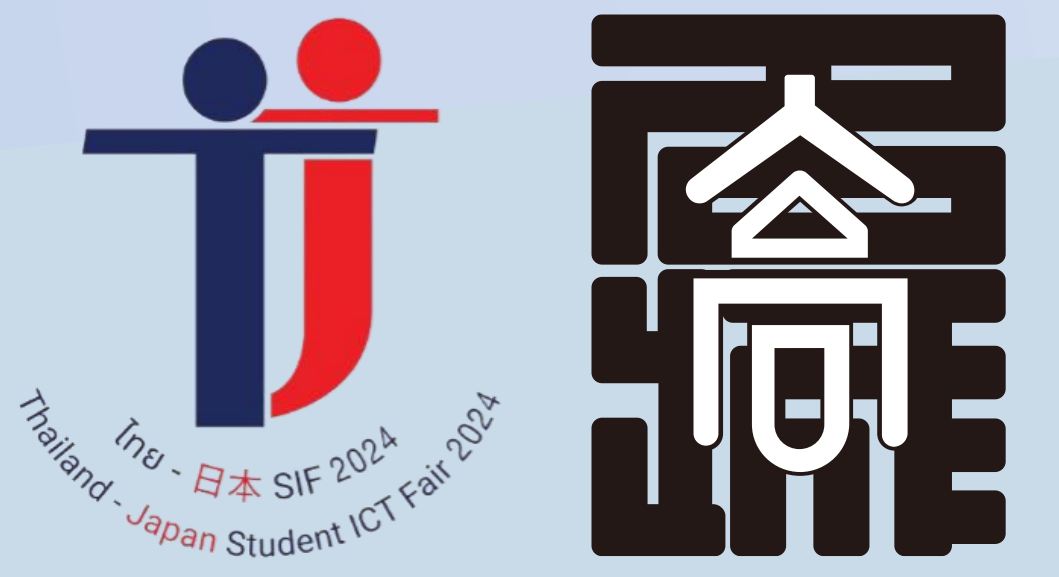# Development and Evaluation of an Attendance Management System Using Face Recognition with Machine Learning
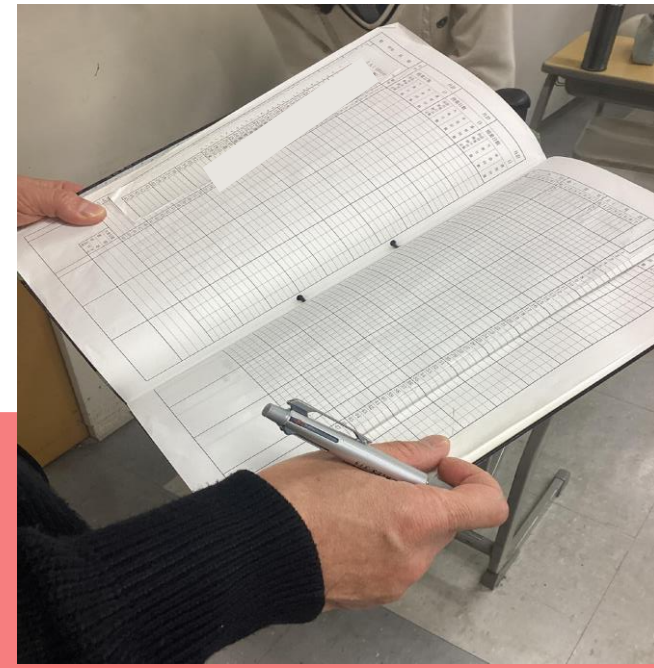
Meijo University Senior Hight School

Kota Yoneda   Fumihiro Kamiya   Sana Ogimoto   Yuka Sawada   Hiyori Yamauchi   Utako Suzuki

Background

· Morning Attendance Check
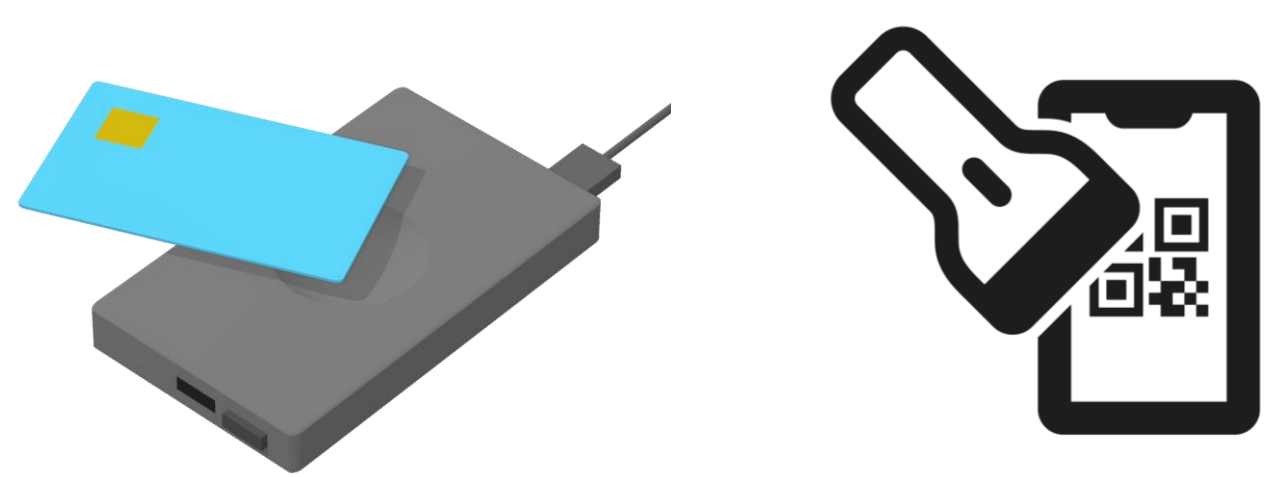Manual work by teachers & Record to list
→**Mistakes may occur**

Actual students' list→

Started development of attendance management system

Previous research and related cases

①Attendance management system using **Felica**[1] or **QR Code**[2]

▶**Forgery is possible**

②Attendance management face recognition system using **CNN**(**Conventional Neural Network**)(correct recognition rate 94.4%)[4]
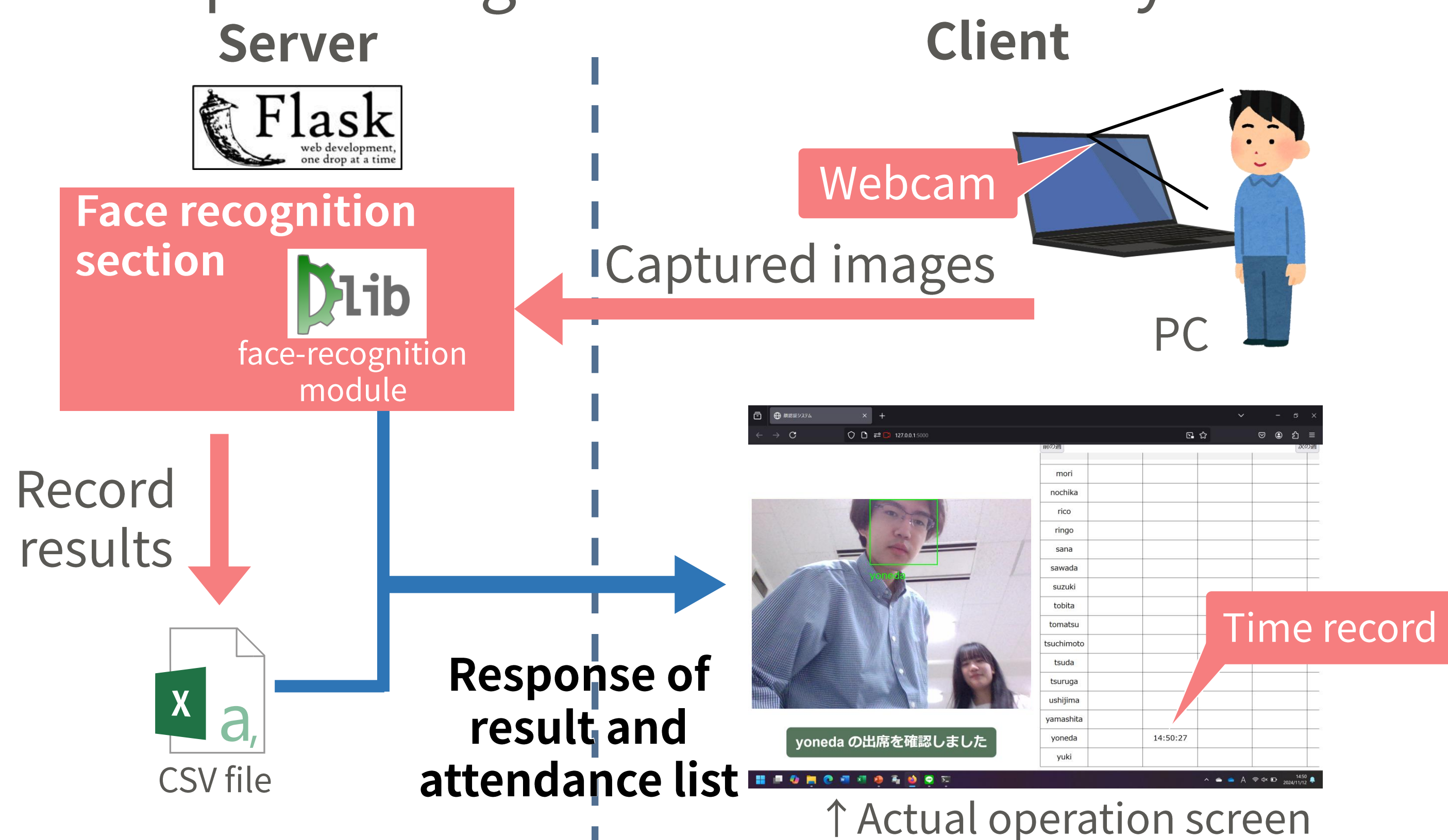
▶**Heavy Calculation**

Impossible to forge & Fast recognition
▶**Face recognition using HOG(Histograms of Oriented Gradients)**
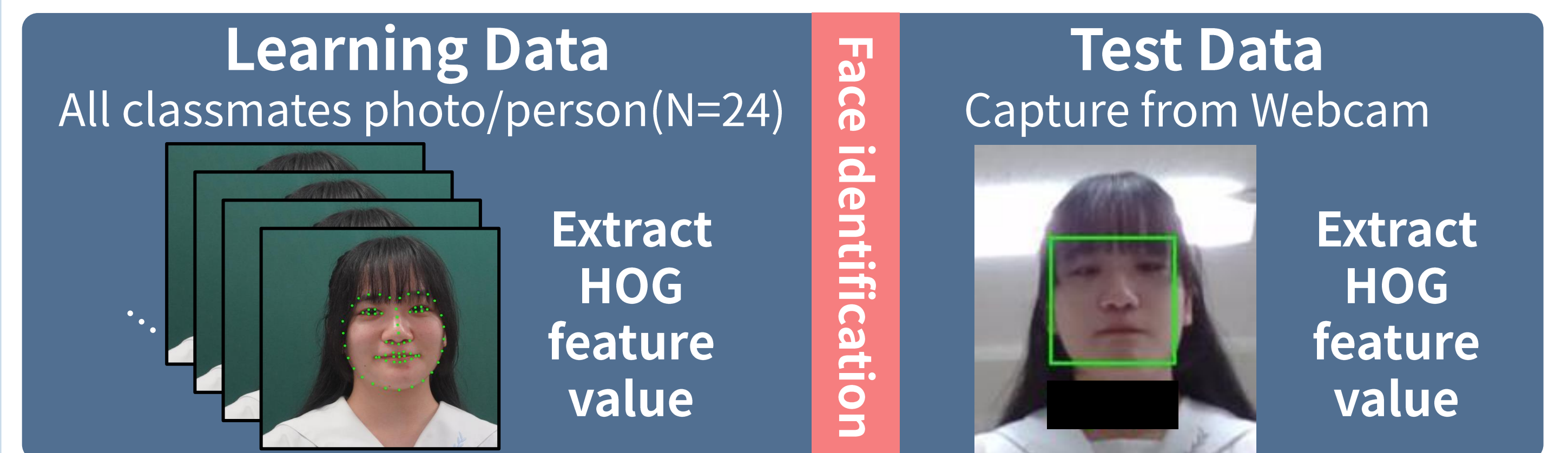
Requirements

- **Accuracy** for correct attendance management
- Authentication as **quickly as possible** with accuracy kept
- Web application for **easy implementation**

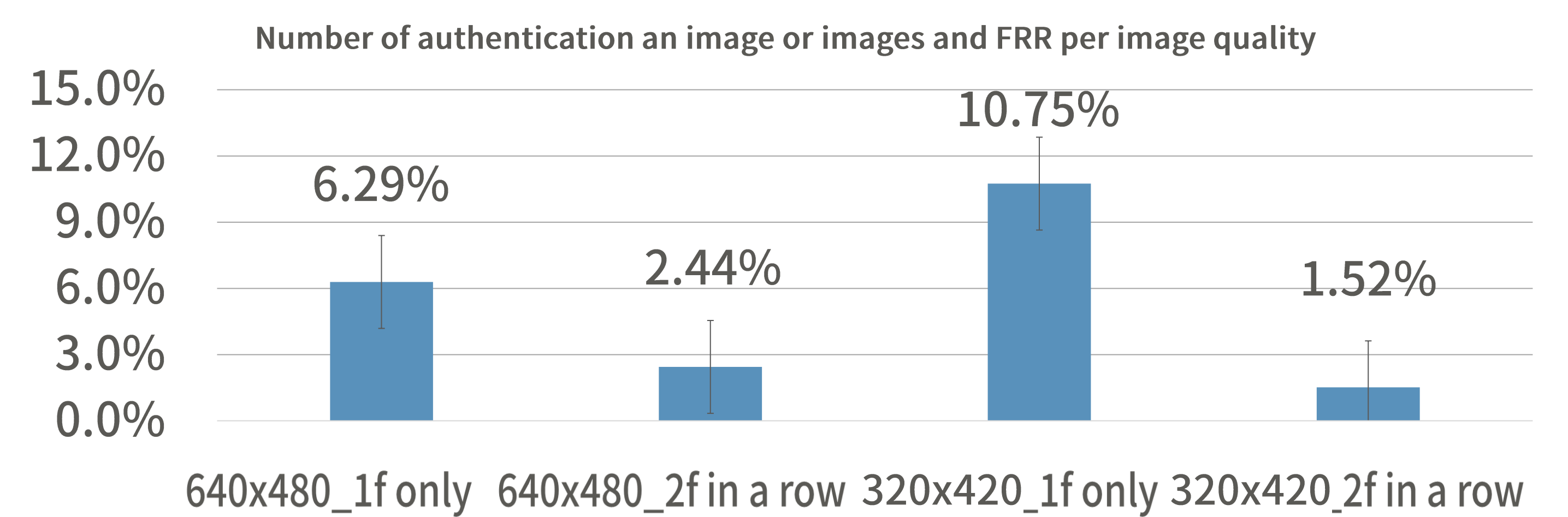## System configuration

Conceptual Diagram of Attendance System

Server   Client

Flask
web development
one drop at a time

Face recognition section

Dlib
face-recognition module

Webcam

Captured images

PC

Record results

CSV file

Response of result and attendance list

Time record

↑ Actual operation screen

Extract 128 feature → compare each Euclid distance. The shortest distance will be the actual person

Learning Data
All classmates photo/person(N=24)
Extract HOG feature value

Face identification

Test Data
Capture from Webcam
Extract HOG feature value

## Evaluation of authentication accuracy

Investigate False Rejection Rate(FRR) 3 times and calculate the average.(N=24)
To reduce the processing time, even though we reduce the pixels from 640x480 to 160x120; ¼, the accuracy is almost the same as before.

Number of authentication an image or images and FRR per image quality

6.29%	2.44%	10.75%	1.52%
640x480_1f only	640x480_2f in a row	320x420_1f only	320x420_2f in a row

2 flames in a row makes no big difference.

Efficiency

Measure processing time from capturing a frame with webcam till the end of authentication.

Processing time per frame
[s]

0.93	0.84
680x480px	320x420px
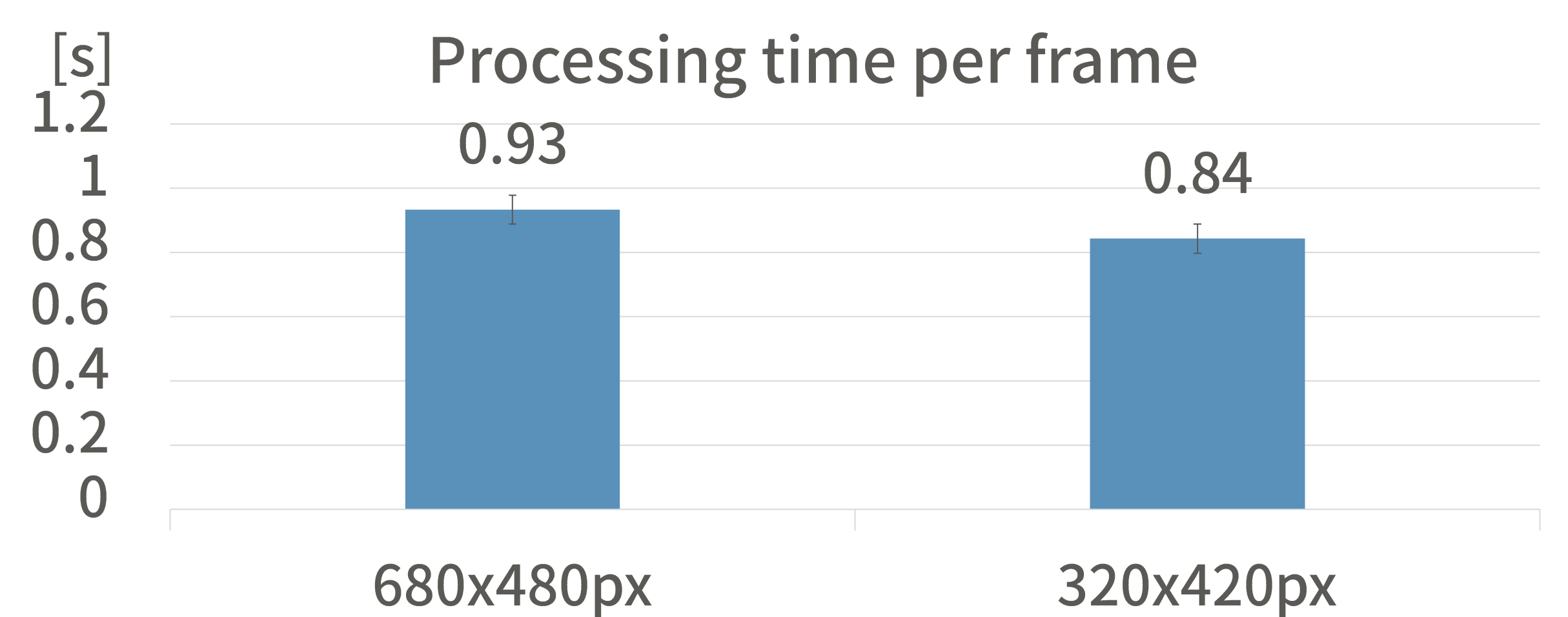
Little decrease in processing time

Summary

- Using face_recognition and dlib, we developed a web application for attendance management by face recognition using machine learning for face detection.
- Lowering the quality of the test data speeded up the process and maintained accuracy.
- Facial feature values are important personal information, so security measures must be taken.

References: [1]Hiroki Uetake, Takeshi Yamaguchi, Hiroshi Yoshikawa "Development of multi-purpose attendance management system using the Felica", 2015, Nihon U. Science and technology, Academic lecture proceedings, https://www.cst.nihon-u.ac.jp/research/gakujutu/59/pdf/A-5.pdf[2] Takuma Iwatsubo, Masayuki Iwai "Development and Implementation of a QR Code-based Entry/Exit and Individual Program Management System for Large-scale Event Operations [ITS]vol. 2024-ITS-99, no. 13, pp. 1–7, Oct. 2024 [3] "Face Recognition" NEC, https://jpn.nec.com/biometrics/face/index.html(accessed Nov 6, 2024) [4] Ogawa, Tetsuji, "Development and Evaluation of Face Recognition Attendance Management System Using CNN" Economic and Business Review, vol. 30, no. 1, pp. 15–22, Oct. 2022