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UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING
Faculty of Engineering

Project Progress 5

Proof of Concept

SECJ3553 ARTIFICIAL INTELLIGENCE

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Smartendance

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Smartendance (AI Face Recognition Attendance)
Proof of Concept

Introduction

Smartendance is a student attendance recording system powered by face recognition technology. In recent years, individuals and organizations are adapting their lifestyles to virtual meetings due to the Covid-19 outbreak. However, After a country has achieved global immunity by taking vaccination, the Government is slowly opening up all sectors including Universities. With the return of physical class, Smartendance is designed to help students take their attendance by face recognition with a camera at each of the classes. This way, students do not have to keep bothering the lecturer to show the attendance QR code and the lecturer is able to focus on his class.

Target Users and Requirements

Target Users	Requirements
UTM student	- The system is able to recognize the identity of a student. - Maximum fault tolerance of face recognition should not be more than 5 times. - The system is able to record the attendance of student immediately once the face recognition success.
UTM lecturer	- The system is able to display the student attendance list to the lecturer.

Architecture of Smartendance

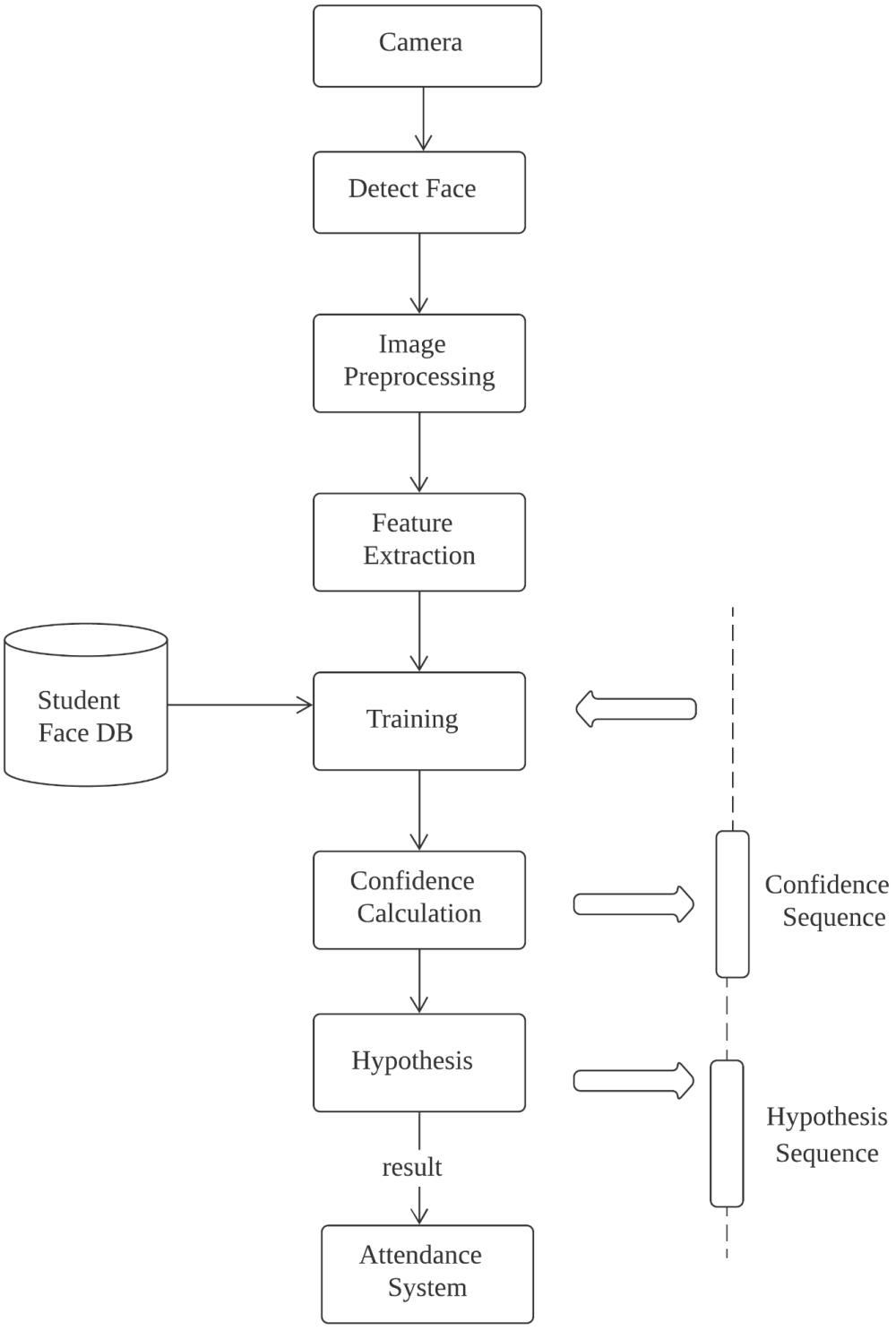

Figure 1 Architecture Diagram of Smartendance

Detail Architecture Description

Face Detection Module

This is the first stage of any face recognition system and the key difference between a semi-automatic and a fully automatic face recognizer. In order to make the recognition system fully automatic, the detection and extraction of faces from an image should also be automatic. Face detection also represents a very important step before face recognition, because the accuracy of the recognition process is a direct function of the accuracy of the detection process.

Image Pre-processing Module

The face image can be treated with a series of pre-processing techniques to minimize the effect of factors that can adversely influence the face recognition algorithm. The most critical of these are facial pose and illumination.

Feature Extraction Module

In this step, the features used in the recognition phase are computed. These features vary depending on the automatic face recognition system used.

For example, the first and most simplistic features used in face recognition were the geometrical relations and distances between important points in a face, and the recognition 'algorithm' matched these distances. The most widely used features in face recognition are KL or eigenfaces, and the standard recognition 'algorithm' uses either the Euclidian or Mahalanobis distance to match features.

Face Recognition Module

This consists of 2 separate stages: a training process, where the algorithm is fed samples of the subjects to be learned and a distinct model for each subject is determined; and an evaluation process (hypothesis and confidence calculation) where a model of a newly acquired test subject is compared against all existing models in the database and the most closely corresponding model is determined. If these are sufficiently close a recognition event is triggered.

Student Attendance Module

This module is using the result from the face recognition system to record the student's attendance. After the attendance recording, the attendance list would be displayed in the lecturer's view. Next, it would respond to the hardware system, if the attendance recording is successful, the signal light would turn green, and otherwise, it would turn red.

Database

Storage of student's face data and student information such as name and matric number.

Training Datasets

BioID database

BioID2 is a dataset consisting of 1521 gray level images with a resolution of 384 × 286 pixels, containing 23 different test persons with frontal views with variations in facial expression and illumination. The actual size of the face inside the picture is on average 128 × 128. From the entire database, 200 pictures of 20 different persons were selected. Faces were selected to maximize pose and illumination variations as far as possible in the selected
picture.

UMIST database

UMIST database4 consists of 564 images of 20 people, each covering a range of poses from profile to frontal views. Subjects cover a range of race/- sex/appearance. The files are all in PGM format, approximately 220 × 220 pixels in 256 shades of grey. From this database, we extracted 100 pictures of 10 subjects, with pictures ranging from frontal up to 30 degrees right and left turn.

Evaluation

The face recognition system considers four features: distance deviation, mean gray value, eye detection change, and neighbor distance.

Distance deviation is based on the distance between the user and the camera. This value can be estimated by using the pixel width of the user's face on the examined image. Distance deviation characterizes the difference between the current user's distance from the camera and the mean distance value overall frames.

The variable mean gray value calculates the average gray value of the extracted face rectangle.

Eye detection change is a binary variable and indicates if the face recognition system was able to detect both face and eyes of a person for the first time after at least one frame where either one of these two detectors failed.

The last variable neighbor distance describes the distance to the next instance when using the nearest neighborhood classifier. Other features, such as hypothesis changes, the angle between the robot's gaze direction and person, have been examined as well but have not shown a significant logistic correlation between the classification result and the variable value.

Prototype of Smartendance

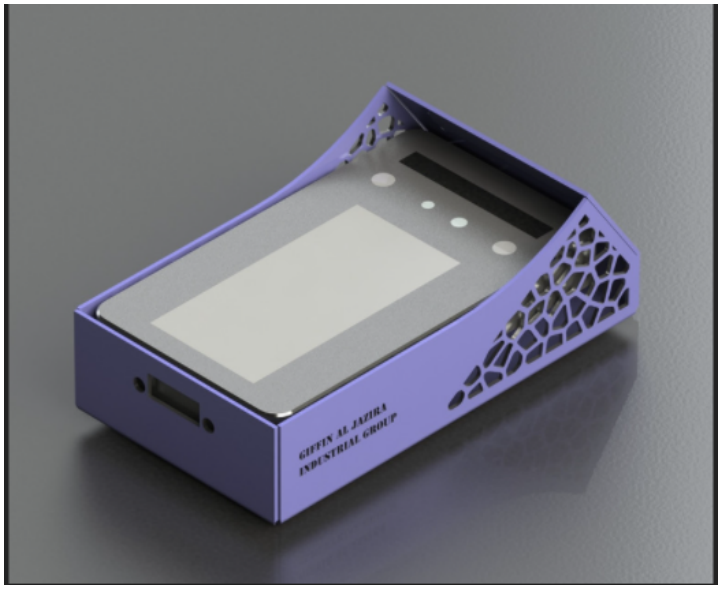

Figure 2 Prototype Concept Diagram

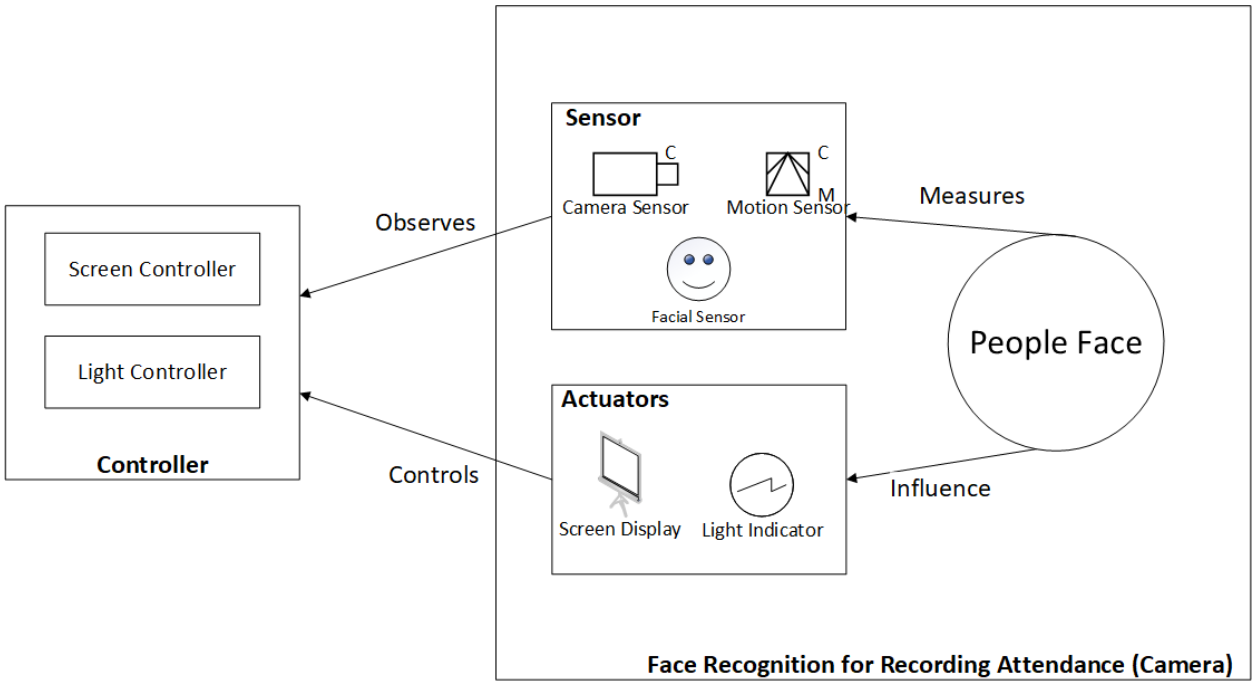

Figure 3 Prototype Details Diagram

References

1. Y. Adini, Y. Moses, and S. Ullman. Face recognition: the problem of compensating for changes in illumination direction. IEEE Trans. on Pattern Analysis and Machine Intelligence, 19(7):721–732, 1997.

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