Lecturer face recognition for authorization of activities in the smart class room

Akhmad Yusuf ZUHDY,

Department of Civil Infrastructure Engineering-ITS, Surabaya, Indonesia E-mail address:
yuf_di@yahoo.com

Totok SOEHARTANTO,

Department of Instrumentation Engineering-ITS, Surabaya, Indonesia E-mail address:
totok.soehartanto@its.ac.id

Abstract

One of the efforts made by the Instrumentation Engineering Department of the ITS Vocational Faculty in supporting the ITS eco campus program is to build a smart classroom equipped with smart class entry authority through face recognition of the lecturer in charge of the course which is integrated with my-its. This is because every ITS lecturer before teaching is required to fill in the material to be taught and student attendance through my-its, so that the integration of the lecturer's face recognition with my-its will be able to provide a decision in the form of authority to enter the lecture room if the lecturer's face matches the data in my-its. With this innovation, the use of electrical energy in each lecture can be recorded in the form of kWh and changed into the cost of using electrical energy and the amount of CO_2 emissions contributed because electricity in Indonesia comes from fossil fuel power plants. This system consists of a camera for face recognition that is connected to the department's Data Knowledge Base which contains photos of lecturers and lecture schedules in my-its. The knowledge base data contains a pair of lecturer photo data and lecture schedules in my-its and an authorization decision to open the door and run all systems related to lecture activities in the smart class room, if the lecturer's face captured by the camera is the same as the data in the knowledge base data.

1. Introduction

ITS, as a campus that cares about the environment, in this case CO_2 gas emissions which cause global warming due to the use of electrical energy from coal fuel, has created the slogan Smart Eco Campus [1]. This slogan was created so that the ITS academic community can monitor the use of electrical energy, so that the Instrumentation Engineering Department of the ITS Vocational Faculty built a Smart Class Room which is equipped with an access system based on matching the face of the lecturer teaching the course with the course data in my-its taught by the lecturer concerned. Smart Class Room is equipped with a webcam in front of the entrance to identify the lecturer's face to be matched with the lecturer's photo in the department's database connected to my-its, if the lecturer's face photo is the same as the lecturer's photo in the Data Base, it will be continued with verification in my-its. If there is a teaching schedule for the lecturer concerned, the classroom door will open and simultaneously turn on the lights, AC and power outlets. So that the electricity usage of each lecturer who uses a smart classroom can be known, by knowing the electricity usage, the cost of electricity usage and the amount of carbon dioxide (CO2) emissions it causes can also be known [2].

This system consists of a camera used to photograph faces which is connected to a personal computer for facial identification using artificial intelligence in the form of an expert system. This system consists of a knowledge database and inference engine [3]. Knowledge

based contains data pairs of facial photos and names of lecturers in the Instrumentation Engineering Department. These data pairs will be used as a database to identify facial photos of lecturers received from webcams using an inference engine. The identification results are then matched with the lecture schedule in my-its in order to obtain authorization to enter the smart class room if the lecturer data matches the data in my-its [4].

2. Materials and method

The system concept for smart class room access is shown in Figure 1.
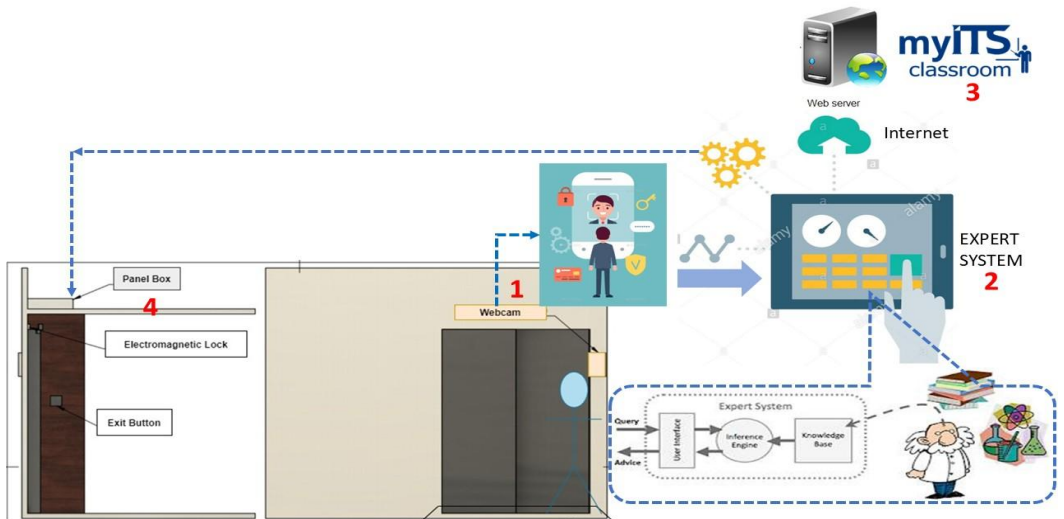
Fig. 1. Flow of access system to smart class room.
Source: Ananta Adji Prabowo's Final Assignment

The smart class room access flow begins with facial identification via the webcam provided in front of the entrance, the facial photo is then sent to a PC equipped with an artificial intelligence system (expert system) for facial identification based on the knowledge database of the lecturer's photo and his/her identity [4]. The results of the facial identification are then sent to my-its via the internet network to validate the data of the lecturer concerned, whether or not they have a teaching schedule. The validation results are then used to access the smart class room [5].

Ensuring Trust and Security in Intelligent Urban Ecosystems
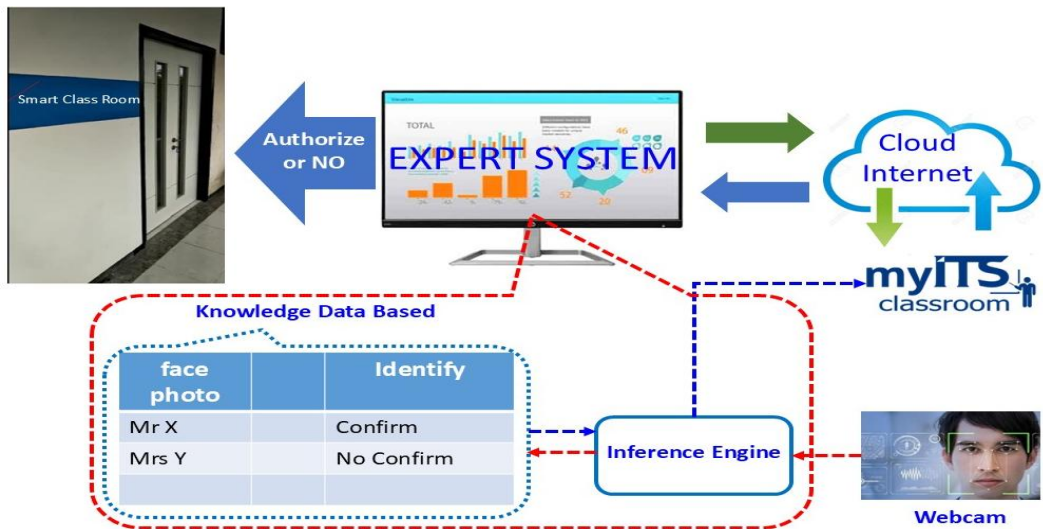
Fig. 2. System flow in granting authorization to enter a smart class room.
Source: Correspondence Author

The electricity in the Smart Class Room will be turned on when authorization to enter the smart class room is granted, so that the electricity usage in the smart class room starts to be recorded.
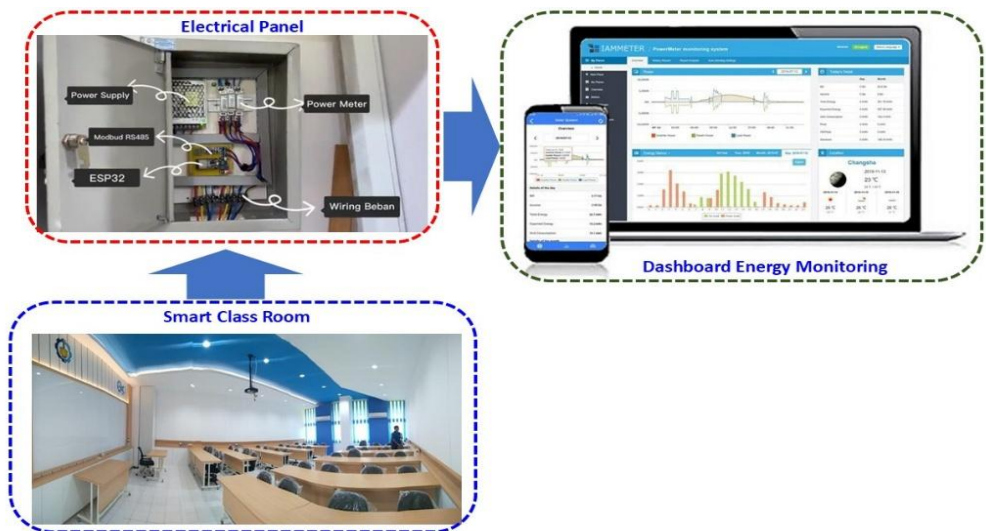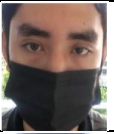
Fig. 3. Energy monitoring system in the smart class room.
Source: Correspondence Author
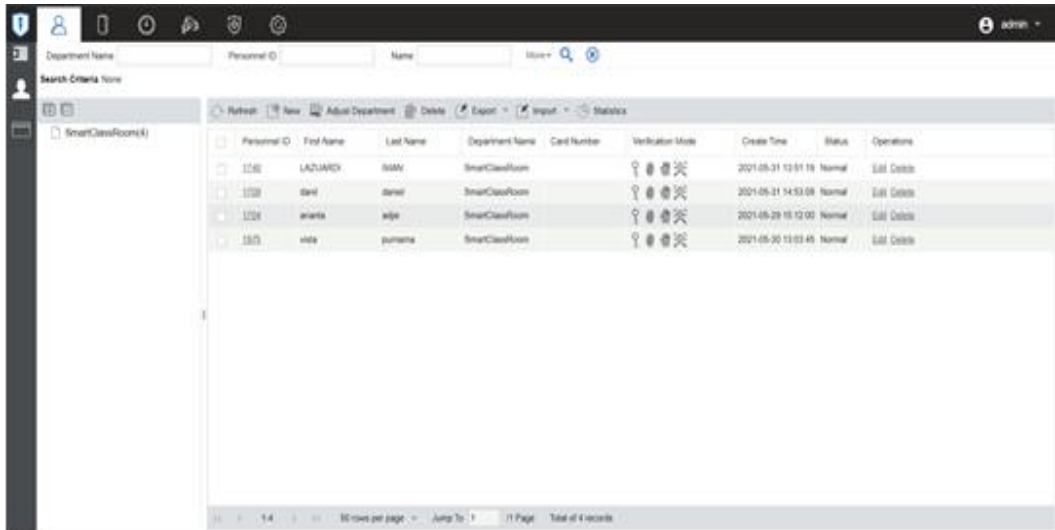
3. Results and discussions

To find out the performance of the smart class room entry authorization system based on facial photos, the following steps are carried out :

Table 1. User registration

User ID	Name	User Role	Fingerprint	Face	Password	User Photo
1704	Ananta Adjie	Normal User				
1709	Danil Daniel	Normal User				
1748	Lazuardi Iman	Normal User				

Source: Ananta Adjie Prabowo's Final Assignment

User Registration shows several user access identities that have been registered by registering several user biometrics including fingerprints, faces, and inputting the name, user role, user photo, and user ID on the ZKTeco V5L TD camera which aims to be used as user access when accessing the smart classroom room [5]. User registration data is stored and processed in the device and server, then the data is converted into a smart class room access control user database. Figure 4. explains the storage of user registration data stored on the ZKBio Access IVS server (server).

Fig. 4. User Registration - Database Server.
Source: Ananta Adjie Prabowo's Final Assignment

If the user's personal data has been registered on the device, the data is directly connected to the server with a data storage display as a user database. If the user access data is successfully stored in the device and server, then the data can be processed as an access user and declared successful in registering the access user (registered), as can be seen below :

Ensuring Trust and Security in Intelligent Urban Ecosystems

Fig. 5. Personal User - Database Server.
Source: Ananta Adjie Prabowo's Final Assignment

Face Recognition is the process by which users access the smart classroom door access control automation system using a ZKTeco V5L TD webcam (device) that has been synchronized with the access control automation system [4].

Table 2. Verification mode by face

Face	Name	User ID	Detection results
	Ananta Adjie	1704	Registered
	Danil Daniel	1709	Registered
	Lazuardi Iman	1748	Registered

Source: Ananta Adjie Prabowo's Final Assignment

Facial recognition testing shows results if the identity has been registered in the device and synchronized in the server, then the user has user access and his identity can be recognized in accessing the smart classroom room with the device display as shown in Figure 6. Verified Access interprets that the user's face has been registered and has access to enter the smart classroom by using face verification [4].
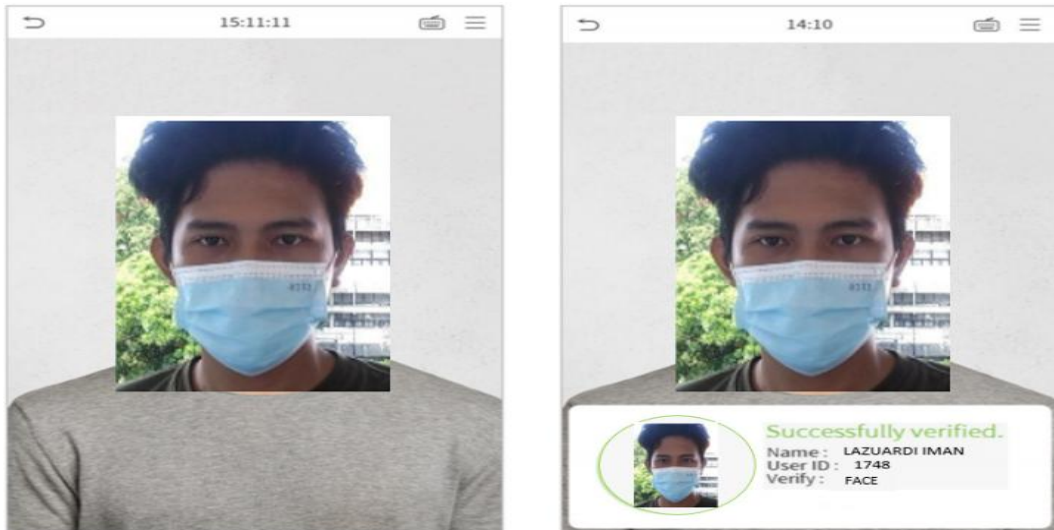
Fig. 6. Verified access.
Source: Ananta Adjie Prabowo's Final Assignment

Figure 6 explains that the user access ID owned by the user has been verified and the user can use user access with verification mode by face identification. If user access is verified, the electromagnetic lock will detect the user access ID on the connected sensor. The detection results will be used to connect the NO1 and COM cables as well as ground and 12v input to the pins available on the sensor in the form of a green LED indicator (locked) and an off LED (open) [4].

Fig. 7. (a) unlocked, (b) locked
Source: Ananta Adjie Prabow's Final Assignment

Ensuring Trust and Security in Intelligent Urban Ecosystems

Acknowledgements

References

[1] I. Virtosu and C. Li, "Bundling and tying in smart living," *Smart Cities and Regional Development (SCRD) Journal,* vol. 6, no. 2, pp. 97-110, 2022.

[2] M. H. Negulescu, "Smart mobility - Challenges for mobility policies and spatial planning," *Proceedings of the 8th Smart Cities International Conference (SCIC),* vol. 8, pp. 259-271, 2020.

[3] B. Zankova, "Smart societies, gender and the 2030 spotlight - are we prepared?," *Smart Cities and Regional Development (SCRD) Journal,* vol. 5, no. 3, pp. 63-76, 2021.

[4] A. A. Prabowo, "Perancangan Otomasi Akses Kontrol Pintu Smart Classroom Menggunakan ZKTECO V5L - TD," 2021.

[5] M. E. Concioiu and G. E. Ristoscu, "The Future of Education: Considerations on Technology and Peer Interaction in Facilitating the Learning Process for a Personalised Education," *Smart Cities International Conference (SCIC) Proceedings.,* vol. 10, pp. 181-190, 2022.