VOLUME 2 NUMBER 2 | JULY - DECEMBER 2017 p-ISSN : 2579-5988 e-ISSN : 2579-597X

DOCTORAL PROGRAM OF ENGINEERING SCIENCE
FACULTY OF ENGINEERING, UDAYANA UNIVERSITY

INTERNATIONAL JOURNAL OF ENGINEERING AND EMERGING TECHNOLOGY

IJEET

Faculty of Engineering, Udayana University | Jl. PB Sudirman, Denpasar, Bali - Indonesia

E-ISSN: 2579-5988, P-ISSN: 2579-597X

INTERNATIONAL JOURNAL OF ENGINEERING AND EMERGING TECHNOLOGY

This journal is the biannual official publication of the Doctorate Program of Engineering Science, Faculty of Engineering, Udayana University. The journal is open to submission from scholars and experts in the wide areas of engineering, such as civil and construction, mechanical, architecture, electrical, electronic, and computer engineering, and information technology as well. The scope of these areas may encompass: (1) theory, methodology, practice, and applications; (2) analysis, design, development and evaluation; and (3) scientific and technical support to establishment of technical standards.

E-ISSN: 2579-5988, P-ISSN: 2579-597X

INTERNATIONAL JOURNAL OF ENGINEERING AND EMERGING TECHNOLOGY

International Journal of

ENGINEERING AND EMERGING TECHNOLOGY

A publication of the Doctorate Program of Engineering Science Udayana University

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Stemming Algorithm for Indonesian Digital News Text Processing

PM Prihatini, IKG Darma Putra, IAD Giriantari, and M Sudarma .....1—7

Characteristics of Tabah Bamboo Activated Carbon Produced by Physical and Chemical Activations

D N K Putra Negara1, T G Tirta Nindhia, I Wayan Surata, and Made Sucipta .....8—11

Experimental Study on the Use of Ejector with Two-Evaporator Temperatures Applied for Performance Enhancement of Split Type AC System

Made Ery Arsana, I Gusti Bagus Wijaya Kusuma, Made Sucipta, and I Nyoman Suamir.....12—16

Characterization Physical, Mechanical, Thermal and Morphological Properties of Colophony

CIPK Kencanawati1, NPG Suardana, IKG Sugita, and IWB Suyasa.....17—19

A Placement and Sizing of Distributed Generation Based on Combines Sensitivity Factor and Particle Swarm Optimization: A Case Study in Bali's Power Transmission Networks

Ngakan Putu Satriya Utama, Rukmi Sari Hartati, Wayan G. Ariastina, and Ida Bagus Alit Swamardika.....20—25

Design and Analysis of Mail Management Information System using PIECES Method: A Case Study at Faculty of Mathematics and Natural Sciences of Udayana University

Made Pasek Agus Ariawan, Putu Bagus Indra Sukadiana Putra, and Putu Arya Mertasana .....26—30

Lecture Attendance Monitoring System Using Face Detection with Microcontroller

Zulfachmi1, Aggry Saputra, and Komang Oka Saputra .....31—36

Security Management Analysis of Security Services Using Framework COBIT 5 Domain DSS05 (Case Study: Document publishing service for Indonesians at Immigration Office Denpasar)

Agus Anwar, Dewa Ayu, and Ni Wayan Sri Aryani .....37—40

Audit E-Signature Public Service Project Using Knowledge Quality Management

Gde Brahupadhya Subiksa, Kadek Ary Budi Permana, and Made Sudarma .....41—46

Design Data Warehouse for Centralized Medical Record

Kadek Ary Budi Permana, Gde Brahupadhya Subiksa, and Made Sudarma .....47—51

Analysis of Enterprise Architecture Design Using TOGAF Framework: A Case Study at Archival Unit of Faculty of Agricultural Technology of Udayana University

Made Pasek Agus Ariawan, Putu Bagus Indra Sukadiana Putra, and I Made Sudarma .....52—57

Analysis and Design Decision Support System of New English Teacher by Using Analytical Hierarchy Process (AHP) in EF English First Bali

Luh Gede Putri Suardani, I Made Adi Bhaskara, and Komang Oka Saputra .....58—61

Decision Support System Terms of Credit Loans using Analytical Hierarchy Process Method (AHP) (Study Case: LPD Temesi Village)

Dewa Ayu, Agus Anwar, and I Wayan Rinas .....62—65

Design of Vehicle Asset Management Information System (Case Study: STMIK STIKOM Bali)

Dwi Ardiada, Merta Suryani, and Ni Wayan Sri Aryani .....66—71

Evaluation of Internal Control System Using COSO Framework (Case Study: Koperasi Nirwana Arta Mandiri)

Aggry Saputra, Zulfachmi, and Yanu Prapto Sudarmojo .....72—76

Data and Information Security Audit Using IT Baseline Protection Manual at PT. XYZ

I Made Adi Bhaskara, Luh Gede Putri Suardani, and Wayan Arta Wijaya .....77—81

Audit IT Division in Maintenance Process Internal System PT Jamkrida Bali Mandara With Framework Software Maintenance Maturity Model (SMMM)

Made Dinda Pradnya Pramita, I Made Dhanan Pradipta, and I Made Sudarma .....82—89

Audit of Governance Information Technology Services Using ITIL v3 Focuses on Service Operation Domain in Institution X

Ni Putu Sri Merta Suryani, I Made Dwi Ardiada, and I Gusti Ngurah Janardana.....90—94

System Decision of Natural Disaster Logistics (Case Study of Mount Agung Eruption)

I Made Dhanan Pradipta, Made Dinda Pradnya Paramita, and I Gusti Ngurah Janardana...95—102

Lecture Attendance Monitoring System Using Face Detection with Microcontroller

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***Abstract*—The implementation of the charging manually lecture attendance list can give rise to various problems in monitoring students in real, spending a lot of files, and will need a room that is spacious enough for archive files lecture attendance When in a long time. Lecture attendance system the manual it's time replaced with a computerized attendance system and biometric features. In this research will be developed the system the presence of lectures based on face recognition and identification help ATMEGA32 microcontroller to open classroom. To be able to identify students facial recognition process on an image that is by using the method of Viola-Jones. From the test results, the success rate of introduction of the application of the presence of a lecture based on the identification of facial features using the methods of the Viola-jones of 89.3%. Moreover the application can store data made the presence of student coursework in database and present information in the form of lecture attendance report.**

***Keyword*— Attendance of Lectures, algorithms viola-jones, microcontroller.**

I. INTRODUCTION

The impact of the digital world is very significant, almost every activity undertaken by companies, government agencies and even the field of academics have used a variety of types of information systems. One example of the current use of the absence of real presence and collaborations with computerized biometric fingerprint functions that have been researched by N. Dhanalakshmi [1]. And the Pss Srivignessh conduct research using RFID attendance attendance card and Invariant Face Verification Based on classroom [2]. As for the concept of automation system developed by Masshood Sajid, a system of automated presence using face detection [3]. both systems automated presence using fingerprints and RFID card that may be popular today but in terms of the risk of fraud posed by both systems are very susceptible to duplicated. For the sake of minimization of cheating the surveyors laid out a system that adopts biometric facial detection and function of microcontroller, where the risk of fraud in duplicating the face very difficult once done.

There are several systems of face recognition research that has been done, one of them an automatic presence systems have been examined by Hemantkumar Rathod i.e. automated attendance system using machine learning approach in the year 2017, on research how to pair the cameras in the classroom to monitor the activity of the students in the class [4]. This system is believed to be able to monitor the activity of the students in the classroom but not fully solve the problem of students who do not take the courses are in the classroom.

The system will be designed to detect each face students who will enter into the classroom[5], The system will automatically provide access to students to get into the classroom or not and the system also combines Card Study Plan and schedule lectures for student activities so as to monitor all students not contracted courses can not be entered into the classroom. This system also helps not to provide access for people who are outside of part campus to enter the room without the knowledge of the internal part of the campus. The system will be controlled from the academic spaces, so that the workload of the academic section and part of logistics can be reduced and they will focus on the work of others. This lecture attendance monitoring system will be simulated with a microcontroller with a goal to reduce accommodation costs of trial and error at the time of implementation system implementation [6]

II. LECTURE ATTENDANCE MONITORING SYSTEM

List of attendance at community colleges is an important point when implementing activities and associated costs. The difficulty of controlling the presence of students in teaching and learning activities resulted in additional work for the academic division. The monitoring system this presence can make a report of the students present at the lecture. The design of this monitoring system will detect each face students who will enter the classroom and this system also uses a microcontroller as the control to open and close the door of the classroom automatically without involving energy humans do.

Microcontroller ATMEGA 32 used is a memory of 32 microchip containing bits and consists of 32 pin. Although the memory capacity is small, but enough to run this monitoring system when opening or closing the door automatically. This system combines the language visual basic programmers and arduino to open and close the door, the camera has been installed in front of the classroom will give the identity of the student's face going into the classroom into information systems attendance of lectures. Monitoring information systems lecture will check the student's identity is already in accordance with data subjects, and the lecture schedule, then

monitoring system will provide a signal to a microcontroller to open and close the door. And the system is also equipped with a high-resolution camera to detect the faces of every student who wishes to enter the classroom.

List of present that has been processed in information systems, system monitoring presence is able to overcome the problem of monitoring the presence of students automatically and reduces the burden on the academic part in checking the attendance of each student's attendance his encounter. And this system surely will reduce complaints from lecturer because students present in class is not in the list of presence of lectures. Because each of its students do attendance automatically using this system then the academic part is quite easy in making monthly reports as well as each semester of the presence of the student and the academic part is also automatically easily monitor student who rarely get in on the lectures and even that never implement College altogether so that the academic part will be easy to contact the student [8].

III. RESEARCH METHODOLOGY

The proposed method of scheme to monitor student attendance is by using a camera with a high resolution which is mounted outside the classroom as shown by Figure 1. Aiming to check each of student who would like to enter the classroom if their identity is in compliance or not with the schedule of lectures and courses taken at the time of the taking of courses. If the identity of the student in accordance with the data retrieval courses and schedule a lecture class and it will open automatically, if it does not match then the student is not granted permissions to enter into the classroom and report to the academic if there are errors that occur. And installed a microcontroller responsible for opening and closing the door of the classroom automatically.

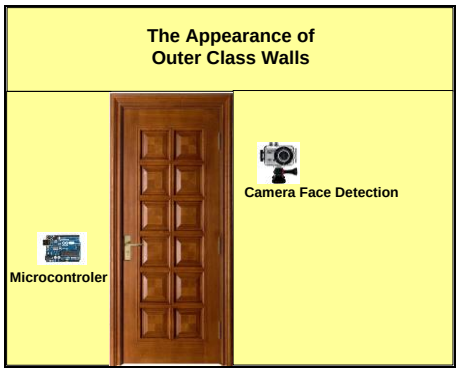

Figure 1. Hardware design that is used

A. Process Flow Monitoring System

Process flow monitoring system starts from students registering ID and face on a monitoring system in the academic section and then the academic section will add the identity of the student with appropriate data subjects the courses taken and Lecture Schedule. After students registered on the system, the student will be given a right of access to enter the lecture room in accordance with the schedule of lectures. Before students enter the classroom, students will validate the face on camera has been installed in front of the classroom to detect the identity of a student, if the identity of the student it is correct then the door will open automatically and student data will be stored with the status of "present" on the course are carried out as described in Figure 2 flow and vice versa if it doesn't fit then the door would not open and students must report to the academic section for verification of data.

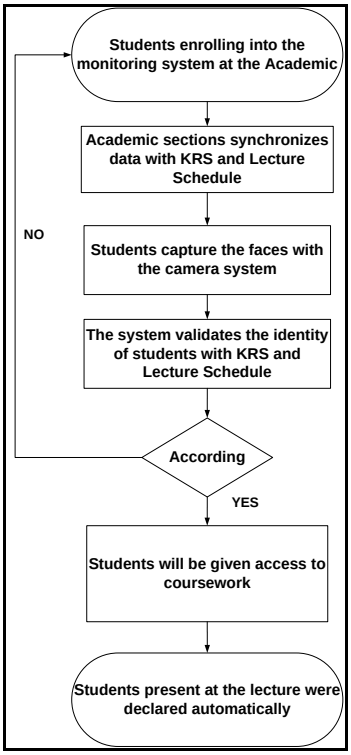

Figure 2. Process flow monitoring system of attendance of lectures

B. Algorithm Of The Viola-Jones

The proposed algorithm is the algorithm of the viola-jones face detect because with a good accuracy so it can determine the identity of each student with the right face and reduce student who will conduct the term leave of absence [9].

Algorithm of viola-jones there are 4 major key that is:

1). Haar Like Feature that is the difference of the number of pixels from the rectangle in Figure 3.
2). Integral image i.e. a technique to calculate value features quickly by changing the value of each pixel into a representation of a new image as in Figure 4.
3). Adaboost algorithm learning is used to improve the performance of the classification with simple learning to combine many weak classifier into one strong classifier. Weak Classifier is a correct answer to the level of truth that less accurate.
4). And the last is a method to combine complex classifier in a tall structures that can increase the speed of object detection by focusing on the area of the image in Figure 6.

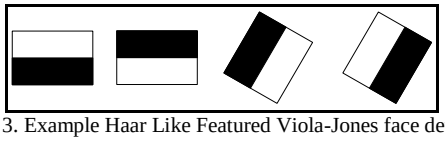

Figure 3. Example Haar Like Featured Viola-Jones face detection

The calculation of the difference between the number of pixels (Haar Like Feature) is obtained from the difference calculate the number of pixels by the number of dark areas of difference between the value of the pixel area light:

$$F(Harr)=\sum Fwhite-\sum Fblack \quad \ldots\ldots (1)$$

Where :

F (Haar) : The value of total pixels

$\sum Fwhite$: The value of the pixels on a bright area

$\sum Fblack$: The value of the pixels on dark areas

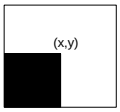

Figure 4. Integral image (x,y)

Based on Figure 6, integral image at the point (x, y) (ii (x, y)) can be searched equation:

$$ii(x,y)=\sum x'\leq x, y'\leq y \;\; i(x',y') \quad \ldots\ldots (2)$$

Description :

ii(x,y) = Integral image at location x, y

i(x',y') = The value of the pixels in the original image

The calculation of the value of a feature can be done very quickly by calculating an integral image on a four point

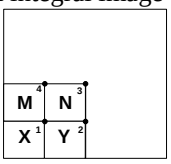

Figure 5. The calculation of the value of the feature

If the value of the integral image of point 1 is X, point 2 is X Y, X 3 is a point of M, and point 4 is X Y M N, then the number of pixels in the region D is knowable by way of 4 1-(2-3)

(1) Statement weak classifier :

$$h_j(x)=\begin{cases}1, & \text{jika } p_j f_j(x) < p_j \Theta_j(x)\\ 0, & \end{cases} \quad \ldots\ldots (3)$$

Description :

is the classification of the weak

J is parity to j

Θj is the threshould to j

x is the dimensions of the sub image e.g. 24 x 24

(2) Statement strong classifier :

$$h_j(x)=\begin{cases}1, & \sum_t^T=1 \alpha_t h_t(x) \geq \frac{1}{2} \sum_t^T=1 \alpha_t\\ 0, & \end{cases} \quad \ldots\ldots (4)$$

(a)

Where :

$$\alpha_t = \log \frac{1}{\beta_t}$$

(b)

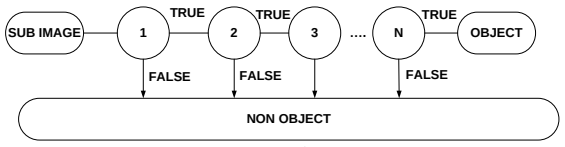

Figure 6. Cascade Classifier Algorithm Structure

Casecade Classifier is a method to combine complex classifier in a tall structures that can increase the speed of object detection by focusing on just the image area.

C. The Process Of Detecting Faces

The process of detecting face is the process to get the value of detecting image features of the face as shown in Figure 7 [10].

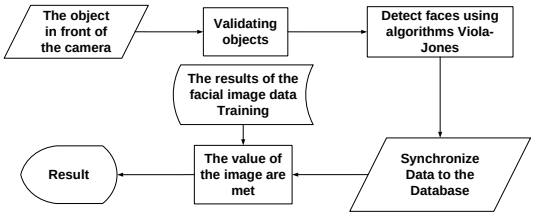

Figure 7. Facial Image Recognition Process

Based on Figure 7, face image recognition process begins from the object captured by the camera. Then the object's validation using algorithmic viola-jones. The results of facial recognition will be fulfilled in accordance with the image data has been training conducted and the data on the database.

D. System Design

Information systems monitoring the presence of lecture using an algorithm viola-jones consists of several processes such as in Figure 10. The system will detect the facial image of the object that will enter the room, then the system will identify the appropriate face image data in the database and if it has been validated then it will open the doors of classrooms and the system will record the incoming object classroom with the status of "present" [11].

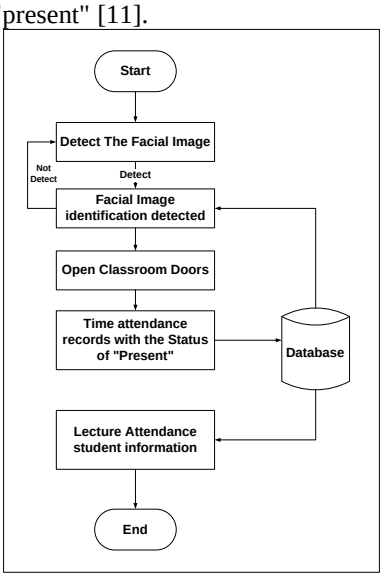

Figure 8. The Process Of Monitoring Information Systems Lecture

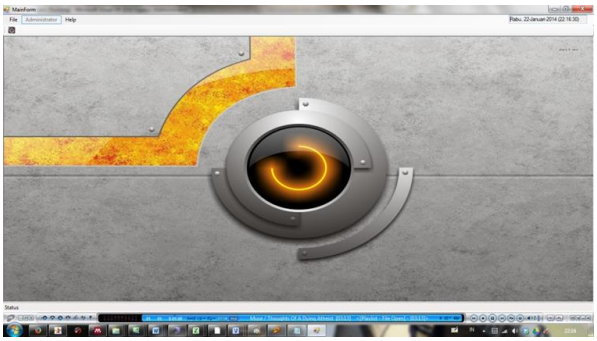

Figure 9. Display The Main Form Of Information System

Figure 10. Display The Form Results Of Face Detection

Figure 11. The Look Of The Face Detect Absentee Form Student

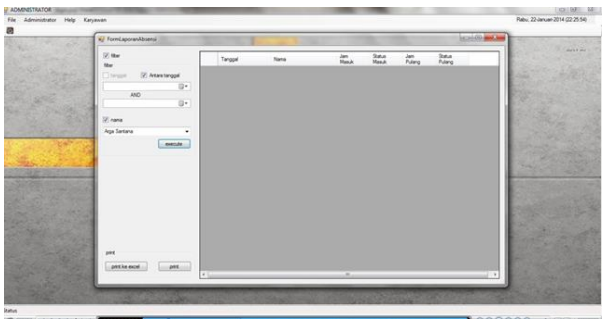

Figure 12. Display Reports the presence of Students and Lecturer

IV. RESULT AND DISCUSSION

A. The Results Of The Testing Process Of Face Detection

Total testing done to 5 students who have registered in the system of monitoring of lectures, the total image of the face in the test is 75 images. Of 75 tested 67 image image successfully detected while the image does not successfully detected 5 and 3 image detected as other students. The results of the Testing process to detect every student faces in monitoring system of lectures presented at the Table. I.

Table I. Results Of The Testing Process Of Face Detection

Student	The test results			The amount of testing
	Detected	Another Student was detected	Not Succesfully Detected	
001	13 (86,7 %)	0 (0 %)	2 (13,3 %)	15 (100 %)
002	13 (86,7 %)	2 (13,3 %)	0 (0 %)	15 (100 %)
003	14 (93,3 %)	1 (6,7 %)	0 (0 %)	15 (100 %)
004	13 (86,7 %)	0 (0 %)	2 (13,3 %)	15 (100 %)
005	14 (93,3 %)	0 (0 %)	1 (6,7 %)	15 (100 %)
Total	**67 (89,3 %)**	**3 (4 %)**	**5 (6,7 %)**	**75 (100 %)**

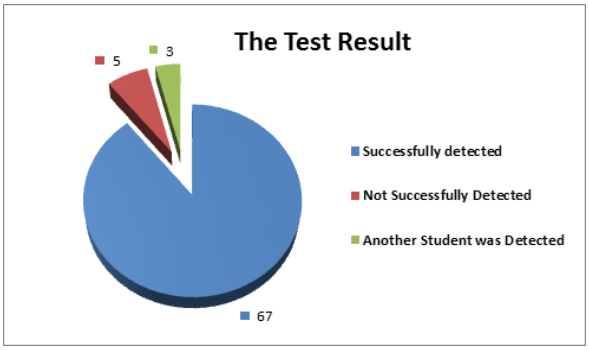

Figure 13. Pie Diagram Test Results

The percentage of success results from the use of the algorithm for viola and jones was 89.3%, this indicates that the algorithm of viola and jones was able to detect the faces of students with precise and accurate.

B. The process of testing student data input

The process of data input of new students aim to test the identity of students enrolling will be inputted into the system information monitoring and associated costs. Test data is presented in table II.

Table II. The process of testing student data input

No	Action	Value	Expected results	Status
Testing the process of data Input of new students				
1	Input of Student Data 001	Name : I Gede Pandya Manuhita	The new student on behalf of I Gede Pandya Manuhita is already registered on the system	OK
2	Input of Student Data 002	Name : Made Johan Gunawan	The new student on behalf of Made Johan Gunawan is already registered on the system	OK
3	Input of Student Data 003	Name : Kadek Arga Santana	The new student on behalf of Kadek Arga Santana is already registered on the system	OK
4	Input of Student Data 004	Name : I Kadek Semaranatha	The new student on behalf of I Kadek Semaranatha is already registered on the system	OK
5	Input of Student Data 005	Name : I Nyoman Darmantara	The new student on behalf of I Nyoman Darmantara is already registered on the system	OK

Based on table II, 5 new students that are inputed into the system information monitoring and associated conditions already succeeded with the status OK.

C. Face detection testing of students

Face detection testing students performed with sun light source and open space conditions. The test detects the faces of students 001 presented on table III.

Table III. Face detection testing Student 001

Image test	Hours of testing	Light source	Place of trial	Description	Status of The Door
	13:00	Sun	Room Open	Successfully detected	Open
	13:02	Sun	Room Open	Failed to Detect	Fail
	13:04	Sun	Room Open	Successfully detected	Open
	13:06	Sun	Room Open	Successfully detected	Open
	13:08	Sun	Room Open	Failed to Detect	Fail
	16:48	Sun	Room Open	Successfully detected	Open
	16:50	Sun	Room Open	Successfully detected	Open
	16:52	Sun	Room Open	Successfully detected	Open
	16:54	Sun	Room Open	Successfully detected	Open
	16:56	Sun	Room Open	Successfully detected	Open
	08:44	Sun	Room Open	Successfully detected	Open
	08:46	Sun	Room Open	Successfully detected	Open
	08:48	Sun	Room Open	Successfully detected	Open
	09:03	Sun	Room Open	Successfully detected	Open
	09:05	Sun	Room Open	Successfully detected	Open

Based on table III testing conducted as many as 15 times. Of 15 times the experiments conducted 13 images successfully identified as student 001 and 2 image is not recognized as a student 001. While testing face detection student 002 presented at table IV.

Table IV. Face detection testing Student 002

Image test	Hours of testing	Light source	Place of trial	Description	Status of The Door
	15:53	Sun	Room Open	Successfully detected	Open
	15:55	Sun	Room Open	Successfully detected	Open
	15:56	Sun	Room Open	Successfully detected	Open
	15:58	Sun	Room Open	Successfully detected	Open
	16:00	Sun	Room Open	Successfully detected	Open
	16:48	Sun	Room Open	Successfully detected	Open
	16:50	Sun	Room Open	Another Student was detected	Fail
	16:52	Sun	Room Open	Successfully detected	Open
	16:54	Sun	Room Open	Another Student was detected	Fail
	16:56	Sun	Room Open	Successfully detected	Open
	08:44	Sun	Room Open	Successfully detected	Open
	08:46	Sun	Room Open	Successfully detected	Open
	08:48	Sun	Room Open	Successfully detected	Open
	09:03	Sun	Room Open	Successfully detected	Open
	09:05	Sun	Room Open	Successfully detected	Open

Based on table IV, has done 15 times an experiment testing detects faces student 002. Of 15 times 13 times trial experiment successfully recognize student 002 and 2 other image detected as other students. face detection testing student 003 presented tables V.

Table V. Face detection testing Student 003

Image test	Hours of testing	Light source	Place of trial	Description	Status of The Door
	15:53	Sun	Room Open	Successfully detected	Open
	15:55	Sun	Room Open	Successfully detected	Open
	15:56	Sun	Room Open	Successfully detected	Open
	15:58	Sun	Room Open	Successfully detected	Open
	16:00	Sun	Room Open	Successfully detected	Open
	16:48	Sun	Room Open	Successfully detected	Open
	16:50	Sun	Room Open	Another Student was detected	Fail
	16:52	Sun	Room Open	Successfully detected	Open
	16:54	Sun	Room Open	Successfully detected	Open
	16:56	Sun	Room Open	Successfully detected	Open
	08:44	Sun	Room Open	Successfully detected	Open
	08:46	Sun	Room Open	Successfully detected	Open
	08:48	Sun	Room Open	Successfully detected	Open
	09:03	Sun	Room Open	Successfully detected	Open
	09:05	Sun	Room Open	Successfully detected	Open

Based on table V, testing on student 003 conducted as many as 15 times an experiment testing. Of 15 times experiment 14 image successfully identified as students 003 and 1 image detected another student. Face detection testing data for student 004 will be presented on the table VI.

Table VI. Face detection testing Student 004

Image test	Hours of testing	Light source	Place of trial	Description	Status of The Door
	16:21	Sun	Room Open	Successfully detected	Open
	16:24	Sun	Room Open	Successfully detected	Open
	16:26	Sun	Room Open	Successfully detected	Open
	16:28	Sun	Room Open	Successfully detected	Open
	09:30	Sun	Room Open	Successfully detected	Open
	09:48	Sun	Room Open	Successfully detected	Open
	09:50	Sun	Room Open	Successfully detected	Open
	09:52	Sun	Room Open	Successfully detected	Open
	09:54	Sun	Room Open	Successfully detected	Open
	14:56	Sun	Room Open	Successfully detected	Open
	14:44	Sun	Room Open	Successfully detected	Open
	14:46	Sun	Room Open	Successfully detected	Open
	14:48	Sun	Room Open	Failed to detect	Fail
	14:03	Sun	Room Open	Failed to detect	Fail
	14:05	Sun	Room Open	Successfully detected	Open

Based on table VI, testing detects faces of students 004 as much as 15 times done. Of 15 times the experiments conducted, 13 images successfully identified as students of 004 and 2 image failed recognized. Data testing face detection student 005 will be served at table VII.

Table VII. Face detection testing Student 005

Image test	Hours of testing	Light source	Place of trial	Description	Status of The Door
	16:21	Sun	Room Open	Successfully detected	Open
	16:24	Sun	Room Open	Successfully detected	Open
	16:26	Sun	Room Open	Successfully detected	Open
	16:28	Sun	Room Open	Successfully detected	Open
	09:30	Sun	Room Open	Successfully detected	Open
	09:48	Sun	Room Open	Successfully detected	Open
	09:50	Sun	Room Open	Successfully detected	Open
	09:52	Sun	Room Open	Successfully detected	Open
	09:54	Sun	Room Open	Successfully detected	Open
	14:56	Sun	Room Open	Successfully detected	Open
	14:44	Sun	Room Open	Successfully detected	Open
	14:46	Sun	Room Open	Successfully detected	Open
	14:48	Sun	Room Open	Failed to Detect	Fail
	14:03	Sun	Room Open	Successfully detected	Open
	14:05	Sun	Room Open	Successfully detected	Open

Based on table VII, testing face detection on student 005 performed as many as 15 times. Of 15 times the experiments conducted 14 images successfully identified as student 005 and 1 image failed recognized.

V. CONCLUSION

Testing on the system monitoring presence as much as 75 times the experiment, the success rate with the use of algorithms and viola jones was amounted to 89.3%. This indicates that the method of viola and jones can be applied on the system monitoring the presence of lectures. This system is believed to be able to assist the duties of academic part that monitor students as well as reporting the presence of students each semester, and help reduce the logistics section to monitor the activities of every classroom.

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