Implementation of Interactive Computer Aided Instruction in Learning of Javanese Traditional Classic Dance

Petrus Sutyasadi and Theresia Suharti

***Abstract*—**Traditional Javanese classic dance is a valuable inheritance in Java Indonesia. Nowadays, this treasure of culture is no longer belonging to Javanese people only. Many art departments from universities around the world already put this as a subject in their curriculum. Nonetheless, dance is a practical skill. It needs to be practices so often while accompanied by an instructor to get the right technique. An interactive Computer Aided Instruction (iCAI) that can interactively assist the student to practice is developed. By using this software students can conduct a self practice in studio and get some feedbacks from the software. This CAI is not intended to replace the instructor, but to assist them in increasing the student fly-time in practice.

***Keywords*—**Computer Aided Instruction, Javanese classic dance, Accelerometer.

I. Introduction

TRADITIONAL Javanese classic dance is a valuable inheritance. Many formal and non-formal education institutions or organization which is intended as the place to learn Javanese classic dance have been established everywhere in Java. Not only that, some universities in the world also put this dance as one of their subject in their curriculum. Therefore, it is very important to keep this value exist. To be able to dance in a good manner needs a lot of practice. The more the students take practice the better their performance will be. Nevertheless, a good basic technique is also an important key that every dancer should have. The right basic technique is proven by experience as the important key to achieve good competence in dancing. The problem now is how long the students will conduct their practice together with an instructor that can give them some instructions or feedbacks, mean while, an instructor does not have all the time to accompany a student.

An interactive Computer Aided Instruction (iCAI) that can interactively assist the student to practice Javanese classic dance is developed. By using this software a student can conduct a self practice in studio by following some instructions and in the same time interactively get some feedbacks. However, in this current experiment, the iCAI only support for dances from Yogyakarta. Yogyakarta is one of the most famous cultural cities in Java which has various kind of dances. One of Yogyakarta classical dance is shown in figure 1. This interactive iCAI is intended to be used as an assistant software to learn the basic poses in Yogyakarta traditional classic dance.

There are several things that a student should know in learning to dance such as: Gendhing (music), Ragam (movement style), Hitungan (counting), and Pose (poses) [8]. One of common basic problem for a new student who will learn to dance is how to pose in the right manner. Pose here means a single particular still position or it can be a starting, an end, or some positions which form a movement. For example there is a still position called *Jengkeng* pose, and also a movement style called *Gudhawa asta minggah* which has many specific positions that construct the movement in a certain count or rhythm. For example the positions that form a *Gudhawa asta minggah* movement are listed in Table 1. [9]

TABLE I
LIST OF POSITIONS THAT FORM *GUDHAWA ASTA MINGGAH*

Start	Ngenceng
1 - 4	Ngoyog kiri
5 - 8	Kembali ke kanan, tangan kanan nekuk nyiku nyempurit
1 - 4	Ngleyek kiri, tangan keduanya lurus turun nglawe, noleh kanan.
5 - 6	Gedrug kanan, tangan mulai nekuk lengkung untuk ukel, noleh kiri
7 - 8	Mayuk jinjit kirim tangan kiri kanan ukel tawing kanan
1 – 2	Pacak gulu, gedrug kanan, noleh kiri, ngleyek kiri
3 – 4	Mapan kanan, tangan kiri tawing kanan, seblak udhet kanan, noleh kanan
5 – 6	Sendhi gedruk ngracik kiri, mapan kiri, tangan kiri nekuk nyiku, tangan kanan ngregem udhet nyiku, noleh kiri
7 – 8	Gedrug kanan, minger kanan, ngleyek kanan, noleh kanan
1 – 2	Gedrug kiri
3 – 4	Mapan kiri, ngleyeg kiri, tangan kiri seleh nglawe, noleh kiri
5 – 6	Gedrug kanan, tangan kiri ngayati ukel jugag di depan
7 – 8	Mapan kanan, noleh kanan, seblak kanan dengan sikap ngenceng, siap untuk pendhapan

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Fig. 1. Javanese traditional classic dance

II. Accelerometer

The main part of the hardware is accelerometer. Even continuously interpolation data matched [3] or best matching [2] between motion and accelerometer will provide better data, this research uses only accelerometer as the position and orientation sensor. An accelerometer is a meter that measures acceleration [1]. Both of dynamic or static acceleration will be measured by the accelerometer. Accelerometer being used in this experiment is ADXL203 from Analog Devices. The detail picture of this accelerometer is shown in figure 2.

Fig. 2 Accelerometer module attached to a wrist band

Earth gravity is a static acceleration. Therefore, it will be detected also by the accelerometer. Because the accelerometer able to detect the gravity, so it can detect the orientation of the student's body such like fore or upper arm, legs or thigh, and head or back. There are ten accelerometers that are used in this experiment. The accelerometer sensor placement is shown in figure 3. Each accelerometer will work in two degrees of freedom. Any inclination angle in X or Y direction will be measured and then would be sent to a personal computer (PC).

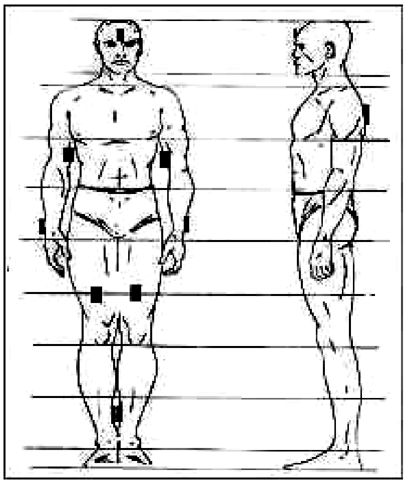

Fig. 3. The accelerometer placement in a human body [7]

III. Graphic User Interface

Graphic User Interface (GUI) for the iCAI is created using Visual Basic 6 programming software. Signal from the accelerometer which is an analog signal will be captured by a microcontroller. Microcontroller being used is ATMEGA8 from ATMEL. Since the points that will be measured is 10 points, and the analog input from the microcontroller is only 8 then an analog selector CD4016BC is used. CD4016BC is a quad bilateral switch from Fairchild semiconductor. Flowchart of the microcontroller program is shown in figure 4 below.

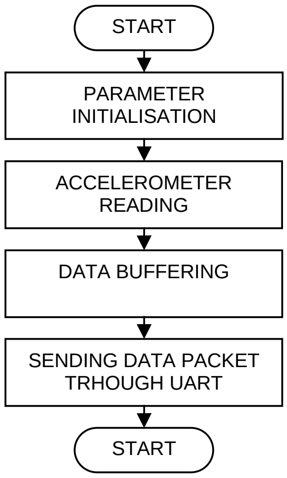

Fig. 4. Flowchart of the microcontroller program

After that, the microcontroller will send the data through an RS232 serial communication to a PC. The GUI software will show the current position from the accelerometer signal as a feedback to the student. Feedback signals from the accelerometer will be compared by some reference value that already saved in a database. By calculating the error, the iCAI will be able to give some correction or suggestion movement to the student. Flowchart of the PC program is shown in figure 5 below.

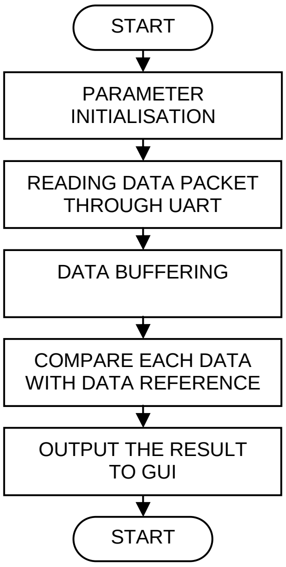

Fig. 5. Flowchart of the PC program

Facilities of this current iCAI are: the student can choose the dance that they want to learn, whether it will be a male or female dance. After that, they can choose any particular pose or movement style including the positions in each of the style using two combo boxes in the GUI. After they have worn the accelerometer already they can start to learn the basic pose that they have chosen. Some text boxes will show some comments regarding to the student position. Each text box represent the feedback of each body link like upper or lower arm, thigh or leg, both left and right respectively. Another two text boxes are for head and back. Feedbacks from the iCAI will give some advice about how to move or orient the body link to get closer to the reference position. There is another large text box which is used to show general description of each pose being selected. The GUI of the iCAI is shown in figure 6.

Fig. 6. GUI of the iCAI

The data that have been received from microcontroller will be compared by a collection of data from a data base. The data base consists of some poses reference data that have been taken from a dance expert. GUI software will translate the error between the actual positions with the data in data base to easy understanding comments. Beside text boxes, the result is outputted into alarm and files.

Each of the body link feedback messages will view a comment what is the orientation need to be taken. The comment would be like a suggestion about to lift up or lowering the arm and rotate a few degrees to the right or left. Therefore, it will be easier to the student to follow the instruction. If the actual position is close enough to the reference position then a sign text will appear. The sign text will inform whether the position is not bad, good, or excellent.

RS232 serial communication using cable can not handle a connection more than 2 meter in length. Therefore, instead of using cable it would be convenience to use wireless technology. In this experiment, an RF link transmitter and receiver using 315MHz is used. This component can handle a data transfer at speed up to 2400bps with distance that can be coverage is up to 500ft for open area. Nevertheless, a cable connection using RS232 is provided also. A self practise directly in front of the monitor computer can be conducted less than 2 meters in distance.

The hardware block diagram is shown in figure 7.

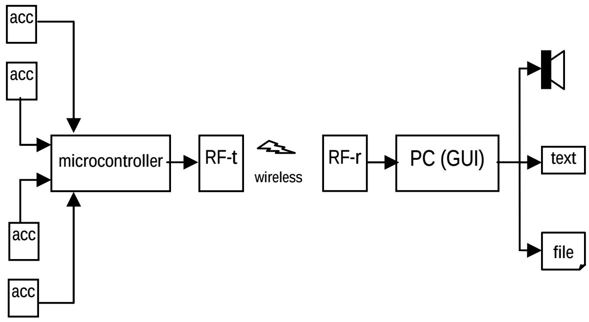

Fig. 7 Hardware block diagram

IV. Experimental Result

Reference values are taken from an expert and professional Javanese traditional dancer. Sample of the resulting data are shown in TABLE II. Data in TABLE II represent body positions value in degree of some poses in a *beksan putri alus* (slow and gentle female dance).

TABLE II
POSITION DATA OF *BEKSAN PUTRI ALUS* TAKEN FROM AN EXPERT

Ngenceng on Nggudawa Asta Minggah		
Body	**X value**	**Y value**
Left Upper Arm (LUA)	45	15
Left Lower Arm (LLA)	68	72
Right Upper Arm (RUA)	122	6
Right Lower Arm (RLA)	113	2
Left Thigh (LT)	88	8
Left Leg (LL)	100	2
Right Thigh (RT)	86	2
Right Leg (RL)	64	6

Head (H)	59	8
Back (B)	80	180

The resolution of the accelerometer is quite small compared to the position consistency of a dancer, even it is taken from an expert. Several data are taken to know the position range that an expert may vary. After ten times of experiment, the range of an expert scale is achieved. TABLE III shows the data from the experiment for X axis only. Table IV shows the data from the experiment for Y axis only. Table V shows the range of minimum and maximum value of each body link position during the ten experiments including the average value of all the data.

TABLE III
POSITION DATA OF X-AXIS ONLY IN *BEKSAN PUTRI ALUS* TAKEN FROM AN EXPERT TEN TIMES

Ngenceng on Nggudawa Asta Minggah										
Body	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
LUA	46	44	43	46	48	46	46	48	48	42
LLA	64	68	63	68	68	63	64	70	68	66
RUA	12	12	12	12	12	12	11	12	12	120
	0	2	4	2	1	0	9	0	2	
RLA	10	10	10	10	10	10	10	10	10	100
	4	4	0	4	2	0	4	0	2	
LT	86	88	87	86	87	87	88	86	86	87
LL	10	10	10	10	10	10	10	10	10	106
	4	2	4	6	6	2	4	4	2	
RT	86	84	84	86	86	84	84	88	84	86
RL	63	64	63	68	68	68	64	64	68	68
H	62	63	64	64	62	64	64	63	62	63
B	78	77	76	76	77	76	78	78	76	76

TABLE IV
POSITION DATA OF Y-AXIS ONLY IN *BEKSAN PUTRI ALUS* TAKEN FROM AN EXPERT TEN TIMES

Ngenceng on Nggudawa Asta Minggah										
Body	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
LUA	15	15	16	14	16	16	15	14	14	14
LLA	72	76	74	71	78	74	74	78	78	72
RUA	6	6	7	8	8	6	8	7	6	6
RLA	2	2	2	4	2	2	4	2	2	4
LT	8	6	6	8	7	6	8	8	6	6
LL	2	4	2	2	4	2	4	2	2	4
RT	8	8	6	4	4	4	6	4	6	6
RL	8	8	6	4	4	4	6	8	6	6
H	8	8	9	8	9	9	8	8	8	9
B	18	17	17	18	18	17	17	17	18	179
	0	9	9	0	0	9	8	9	0	

TABLE V
MIN-MAX AND AVERAGE VALUE OF EXPERIMENT DATA IN *BEKSAN PUTRI ALUS* TAKEN TEN TIMES FROM AN EXPERT

Body	MIN X	MAX X	AVG X	MIN Y	MAX Y	AVG Y
LUA	42	48	45,7	14	16	14,9
LLA	63	70	66,2	71	78	74,7
RUA	119	124	121	6	8	6,8
RLA	100	104	102	2	4	2,6
LT	86	88	86,8	6	8	6,9
LL	102	106	104	2	4	2,8
RT	84	88	85,2	4	6	5
RL	63	68	65,8	4	8	6
H	62	64	63,1	8	9	8,4

B	76	78	76,8	178	180	179, 3

An instructor can set the grade of competency by setting the min or max value of each grade relative to the reference average value. The default setting of grading scale in the software is shown in TABLE VII.

TABLE VII
GRADING INTERVAL USING THE iCAI

Grade	**Range of min-max**
Ecellent	±5
Very Good	±13
Good	±15
Satisfactory	±20
Unsatisfactory	±30 or more

The data which is resulted from the student experiment or practice can be saved in to a file.

V. Conclusion and Future Work

. The iCAI software can be used by a student to assist them in a self study program. The study program can be conducted whether in studio or at home, as long as the student has their own software and hardware. By managing some self study assignments the student can improve the time taken to achieve the competency. Therefore the instructor can give any additional material for the student or increase student drilling time.

Secondly, by documenting the dance notation in a detail position like in iCAI, it can reduce some movement deviations due to the misinterpretation of each instructor that may happen from time to time during the transfer process.

This iCAI which is intended to support student's dancing competency in school, is still need to be improved. This stage of research is the first step from the whole road map in this topic. In the future, the next version will accommodate a measurement in transient position during poses transition. The drawback of an accelerometer in transient time needs to be compensated by a gyroscope [5]. Both sensors need to be filtered by a Kalman Filter to get the best result[6]. In the transient version the iCAI software will equipped with video recording facility. Each error beyond the allowed value will trigger a video pause and simultaneously show a correction. Later on the final version, the iCAI is expected can feel the muscle stress and strain by using the electro myograph technology. Misallocation of muscle stress in body will affect an improper pose in dancing.

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