Application of Background Estimator System in E-Learning

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***Abstract* – On the application of e-learning, we often find learning using video streaming. There are two ways of making a video streaming : capturing video in the classroom and capturing video by computer simulation. Making video streaming in the classroom is more difficult to apply because the lecturer always moves. Because of the dinamical movement of the lecturer this application requires an operator to direct the video camera.**

To minimize the need of an operator, we need a video camera which can move automatically following the position of the lecturer. One way to make the camera be able to move automatically following the lecturer's position is by using background estimator method based on image process.

This method provides information to the computer about the position of the lecturer. Then computer drives the motor stepper systems to move the video camera. So, the video camera follows the movement of the lecturer's positions.

***Keywords* – Automatic, Background Estimator, Lectures's Position, Video Camera, Video Streaming**

I. INTRODUCTION

The development of distance learning is growing fast, from just upload and download data until there is interaction between student and teacher. This interaction expands with technology chat, voip, live video streaming. Development streaming video applications from downloading the file containing the video until the live recording applications. This makes classroom teaching can be done remotely and in real time.

Streaming video applications are divided into two ways of making a video in the classroom and making simulations using a PC. In streaming video creation in the classroom is more difficult to apply because the teachers are always moving. As a result of this dynamic movement of teachers, required an operator to direct the video camera follow the movements of teachers. The function of this operator is very important in shooting video. So the video image capture applications in the classroom must wear an operator.

To minimize the operator needed a video camera that can move automatically follow the teacher's position. The system is done by video camera connected to a PC to detect the position of teachers, if teachers move to the right then on the PC will provide information that teachers moving to right. This information is a signal which is then via the parallel port interface to the stepper motor. Stepper motor that will move the video camera. So the video camera can be moved automatically follow this teaching position.

Video camera to the PC input will be used to detect the teacher's position with a background estimator method, which compares teaching position at an earlier time with a teaching position at the present time. If there is movement and the areas that still set the PC does not deliver signals to the stepper motor. But if it had passed the areas that have been defined then the PC will give the signal to the stepper motor to move to follow the teacher's position.

II. POSITION DETECTION

Detection of object motion can simply be done by finding the difference between two successive images on the imaging results

using a digital video camera. A digital image is composed of matrix elements in a certain size. Each of the elements in the matrix is a representation of the degree of gray-intensity values are displayed. Therefore, to know the difference between two images is the same as subtracting two matrices. The equation used is as follows:

$$C(x,y) = A(x,y) - B(x,y)$$

C(x,y) : image result
A(x,y) : capture image n
B(x,y) : capture image n-1
n : Time

By evaluating the difference in value, it can be known whether the image contained a moving object. With this reduction operation, no moving parts that will generate value = 0 and the moving parts generate value ≠ 0.

Figure 1 shows the process of reduction of between 2 pieces of gray-level image of size 4 4 pixels with gray level 4 bits (15 levels of color).

$$\begin{bmatrix} 15 & 0 & 2 & 4 \\ 7 & 14 & 15 & 13 \\ 3 & 8 & 1 & 9 \\ 11 & 10 & 6 & 12 \end{bmatrix} - \begin{bmatrix} 15 & 0 & 2 & 4 \\ 7 & 6 & 3 & 13 \\ 3 & 5 & 12 & 0 \\ 11 & 12 & 14 & 12 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 8 & 12 & 0 \\ 0 & 3 & -11 & 9 \\ 0 & -2 & -8 & 0 \end{bmatrix}$$

Matriks A Matriks B Matriks C

Fig.1 Process of Reduction

III. HARDWARE

Computer-related hardware through the port. Port is a kind of gate that serves as an access gateway (incoming data and outgoing data) between hardware with software. There are several types of ports, including the following USB, Serial, Parallel, ATA, SATA, etc. For the drive system uses a parallel port WebCam.

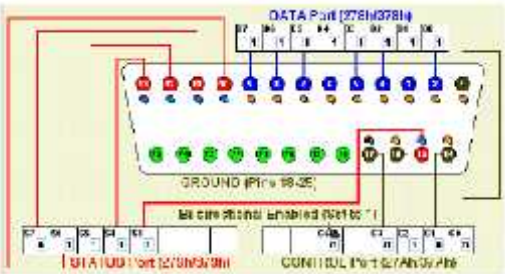

Fig.2 Parallel Port

Port Parallel (DB-25) is one type of socket on a personal computer to communicate with external devices such as printers older models. Because it is often also called a parallel port printer port. Companies that introduce these ports are Centronic, then the port is also called the Centronics port.

Motor Stepper Driver (IC ULN2803)

The main components of this stepper motor driver IC ULN2803 is composed of a series of Darlington transistors are connected in one package. The main circuit ULN2803 IC images can be seen in the figure below.

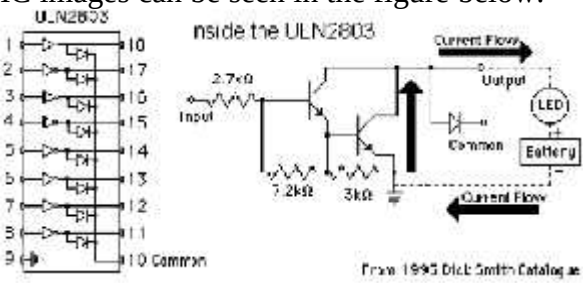

Fig.3 ULN2803

Video camera connected to a PC to detect the position of teachers, if teachers move to the right then on the PC will provide information if the teacher moves to right. This information is a signal which is then via the parallel port interface to the stepper motor. This stepper motor that will move the video camera. So the video camera can be moved automatically follow this teaching position.

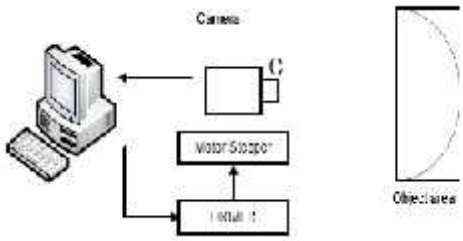

Fig.4 Applied Motion Detection

To detect movement of teacher positions. Conducted in the following ways;

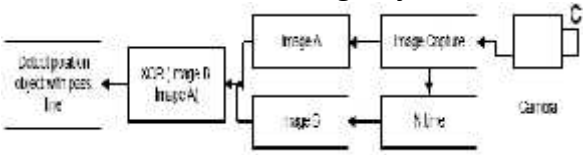

Fig.5 Motion Detection Diagram

In the picture has been given an area constraint. to provide restrictions when images of objects beyond the right or the left boundary.

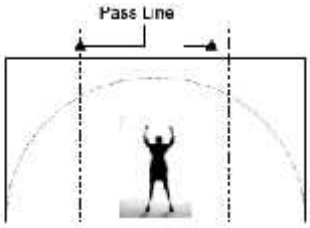

Fig.6 Image area

Flowchart this program:

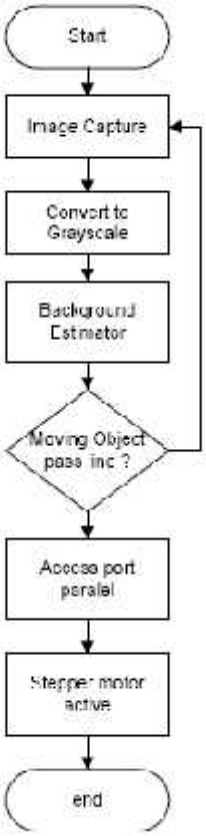

Fig.7 Flow Chart

IV. APPLIED

Object motion detection process starts by summing the matrix values of each region in the first image and the image of the reduction. Addition is done by using the following algorithm:

summing the value of the matrix region of the left image of the first

lsumtot1 = sum (sum(lpic1));

summing the value of the matrix region of the first image right

rsumtot1 = sum (sum(rpic1));

summing the value of the matrix region of the left image of the second reduction

lfsumtot = sum (sum(lfpic));

matrix comparing the number of values of each region between the first and second image reduction with the first image

```
lrange = lfsumtot/lsumtot1;
rrange = rfsumtot/rsumtot1;
if lrange > rrange && lrange >= 0.05
x='kiri';
elseif rrange > lrange && rrange >= 0.05
x='kanan';
else x='diam';
end
```

value region of the left image comparison with the results of the first image reduction is greater than the value of the comparison region and right have greater value equal to 0.05 or 5% of the detected object will move toward the left region. Meanwhile, when the comparison result of the reduction region of the right image with the first image that is greater than the value of the comparison region of the left and has a greater value equal to 0.05 or 5% of the detected object will move to the right region. But when the second comparison value region of the left and right did not reach 0.05 or 5% of the detected objects will not do the movement.

Total value of the matrix region

	Left	Right
The first image	3242809	5514697
Image of the reduction	248419	365402
Image of the reduction: The first Image	0.0766	0.0663

After knowing the position information of the object then the next step is to send signals to the stepper motor to move. In the following way:

```
a = circshift ( a, [0 1]);
putvalue (dio,a);
a = circshift ( a, [0 -1]);
putvalue (dio,a);
```

IV. CONCLUSIONS

1. The system can detect movement of an object through the image that has been converted to grayscale to facilitate the counting process as a grayscale image has only one value for each element matriknya.
2. Object movement detection process sometimes still less accurate. This is due to several factors, among others:
   - Ability to use PC software Matlab affect the speed of object movement detection process.
   - The intensity of light changes also affect the process of detecting the movement of objects so that the detection results are often not optimal. For example an object when a light is too bright will have a different element value when the object is to get enough light or dark.
   - Movement of objects that are too fast produces capture images that are not clear (blur) and thus affects the movement direction of the object detection results.
   - If there are two objects that perform the same movement in the opposite direction, then the webcam will only follow an object that has a value greater contrast.

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