Augmented Reality Approach to Introduce Batik Garutan Using Features Accelerated Segment Test

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Abstract— **This study aims to introduce the art of Batik Garutan with a variety of existing motifs using Augmented Reality (AR) technology so that Batik Garutan can be known interestingly, the method used is Features from Accelerated Segment Test (FAST), where there are several stages of the process including the process of resizing the image, the process of changing the image to grayscale, the process of alignment of gray color (Histogram), and the threshold process for determining the point on the marker. Marker objects are used in Batik Garutan motifs in the form of fabrics, shirts, and dresses. The FAST Corner Detection algorithm on Batik Garutan can detect markers with an average detection time of 0.315. The introduction of Batik Garutan on android mobile devices is very beneficial, practical, and easy to use. It is seen from questionnaires conducted by 42 respondents with an average percentage of answers reached 85.94%, which means it falls into the category very well.**

Keywords—Augmented Reality, Batik Garutan, Features Accelerated Segment Tes.

I. INTRODUCTION

Along with the development of batik and the increasingly known batik as a heritage of Indonesian tradition, almost every corner of Indonesia has its distinctive batik, one of which is Garut. Garut has its batik characteristic, called Batik Garutan, but still many do not know about Batik Garutan itself. Batik itself is one of Indonesia's cultural heritage that has gone global and becomes Indonesia's brand image registered and recognized by the United Nations of Educational, Scientific and Cultural Organization (UNESCO) and obtained copyright as one of Indonesia's rich cultural heritage. In Batik Garutan, there are many motifs that are inspired by people's lives, such as Bulu Hayam batik motifs, Lereng Kangkung batik motifs, Merak Ngibing Batik motifs, Lereng Barong Batik motifs, Cupat Manggu Batik motifs and so on. Therefore many Batik Garutan industry continues to create new motifs with their meaning[1].

Along with the development of technology, the application of Augmented Reality Technology (AR) is currently widely used for the media introduction of a characteristic regional product to be known by the general public because it provides an exciting user experience. Augmented Reality (AR) is a technology that connects virtual worlds in both 2D and 3D into the real world in real-time[2]. Two categories must exist in Augmented Reality, namely based on the presence or absence of markers (Marker-Based) and without markers (Markerless). AR is a multimedia technology that is currently widely used for learning because it is considered more interactive and interesting[3][4][5], including Tajweed learning[6], hijaiyah letter learning[7], digestive organ learning[8], application of AR for tourism[9], Health care education[10], marketing strategies[11], and AR implementation in other fields.

Indonesia is a rich country, recorded Indonesia has 13,446 islands, 726 regional languages and recorded to have 5849 types of batik, including Batik Garutan based on research conducted by Bandung Fe Institute, the many types of batik makes the public less familiar with the batik, so researchers want to emphasize more on the introduction of Batik Garutan motifs. This research aims to implement Augmented Reality technology to better introduce Batik Garutan by following the development of an era where a 2D object becomes

visible 3D. The method used is Features from Accelerated Segment Test (FAST) Corner Detection as a determinant of corner point or angle detection to detect the angle of an image[12].

II. RESEARCH METHOD

In the research on the introduction of Batik Garutan using augmented reality technology, there are stages of research activities as shown in Figure 1. below:
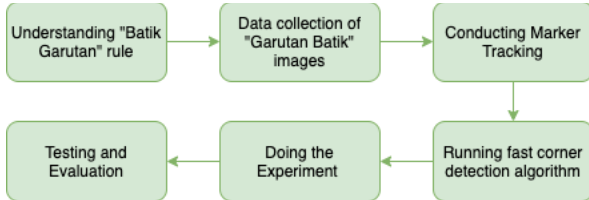

Fig. 1. Activity Research

A. Augmented Reality

Augmented Reality Was first used from 1957 to 1962 by a cinematographer named Norton Heilig, named Sensorama. Sensorama is a simulator that can simulate visuals, vibrations, and smells. Augmented Reality can be used in various activities, such as presentations, estimating an object, work stimulant equipment, and others[5].

There are three characters from Augmented Reality, namely the combination of natural with virtual, Interactive and in real-time, Presented in three-dimensional form. Augmented Reality technology in its application can be intended for all senses ranging from hearing, vision, and touch. This technology is used in some areas such as entertainment, medicine, robot design, learning media, and promotional media[5].

In general, Augmented Reality has two methods, Marker Tracking is a method that uses Markers to bring up its 3-dimensional Objects, and Markerless Tracking is a method that does not use markers to bring up its 3-Dimensional Objects[13][14]–[16].

B. Features from Accelerated Segment Test (FAST) Corner Detection

The Features Accelerated Segment Test method is a method developed by Edward Rosten, Reid Porter, and Tom Drummond. It was built with the aim to speed up real-time computing time to lower the accuracy of angular detection. FAST Corner detection determines the corner point by changing the image to black-and-white color and running the algorithm. This corner point determination facilitates scanning angle angles to display 3D images through predefined 2D images[6][12].

This FAST Corner Detection method uses a type of High-Speed test where the application of this method takes 4 points from 16 pixels then compares 4-pixel intensity with the p point as the center point, each pixel in 16 pixels is divided into three predefined comparison states such as (1) for darker, (2) for similar, (3) for brighter[17][6].

$$I_{p \to x} \leq I_p - t \qquad (1)$$
$$I_p - t < I_{p \to x} < I_p + t \qquad (2)$$
$$I_p + t \leq I_{p \to x} \qquad (3)$$

where,

Ip = Intensity of center point

In = nth neighbor intensity point

t = threshold value

$Ip \to x$ = pixel intensity of x

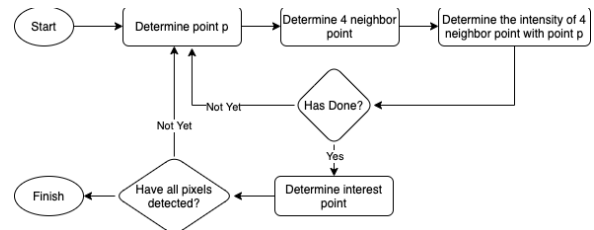The FAST Corner detection process can be seen in figure 2

Fig. 2. Flowchart of FAST Corner Detection

III. RESULTS AND DISCUSSION

This section will discuss the research results, from data collection to evaluation of the results of experiments conducted

A. Understanding of Batik Garutan and Image Data

Data used in the form of Batik Garutan motif design, there are 10 batik motifs used, namely the motif of *Lereng Barong, Lereng Ageung, Merak Ngibing, Lereng Suliga, Manggis, Lereng Jaksa, Lereng Kangkung, Patah Tebu, Sapu Jagat*, and *Suliga Bunga*, from each motif consists of 3 marker images, namely fabric markers, shirt markers and dress markers, Batik Garutan motifs are shown in figure 2 below :
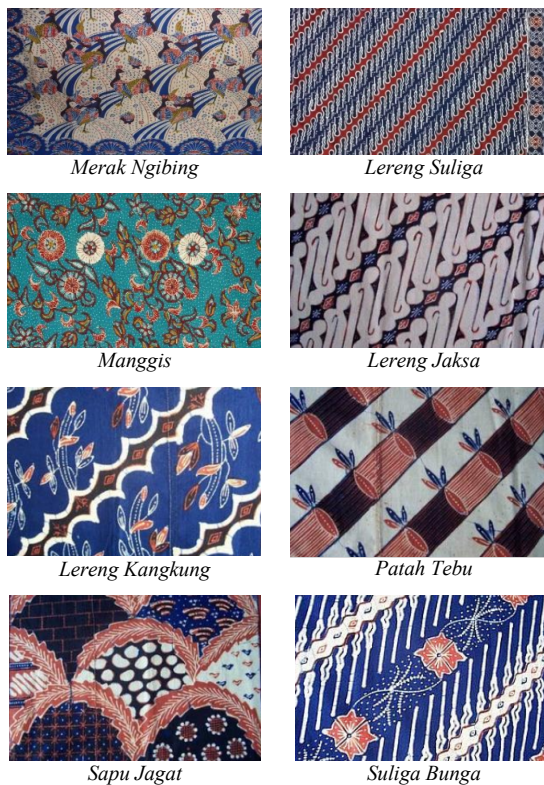

Lereng Barong   *Lereng Ageung*

Merak Ngibing

Lereng Suliga

Manggis

Lereng Jaksa

Lereng Kangkung

Patah Tebu

Sapu Jagat

Suliga Bunga
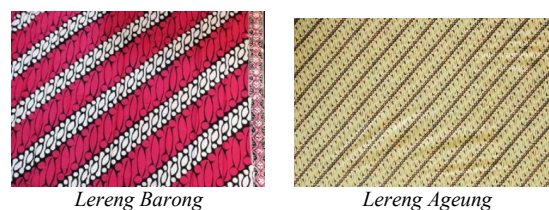
Fig. 3.   Batik Motif

B. *Implementation Features from Accelerated Segment Test (FAST) Corner Detection*

Once the image data is known, then fast implementation, batik image will be processed as a marker, .jpg or .png format image uploaded to the Vuforia website through the marker engine provided by Vuforia to produce a file with a unit package format with a maximum file size of 2MB to be singled out on the Target Manager System provided by Vuforia, the image or image will be resized, converted in grayscale form, converted back in histogram form, the threshold to become a marker, depicted in figure 4.
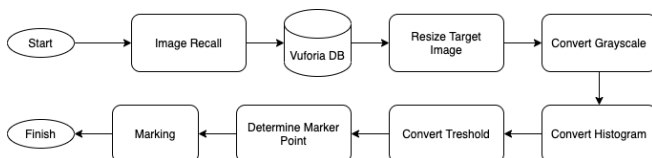

Fig. 4.   Stages of marker formation

Based on the previous discussion listed in figure 4, that the next step is to resize. After the image is inserted into the Vuforia database, the image size is automatically reduced to 320*320 pixels shown in figure 5.
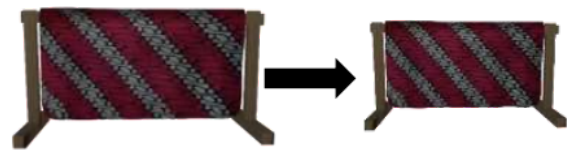

Fig. 5.   Resize Image

After successfully minimized, the process of converting grayscale is to change from RGB to Grayscale or change the image to grayish or Grayscale process with an intensity of 0 for black, 255 for white, and vulnerable 0 - 255 for gray color shown in figure 6.
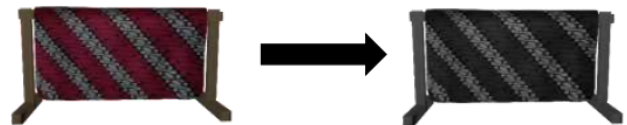

Fig. 6.   Convert RGB to Grayscale

The next step converts grayscale to histogram where degrees of grayish color is leveled, shown in figure 7.

Fig. 7.   Convert Grayscale to Histogram

Figure 8 illustrates the change from histogram to the threshold, which describes a threshold intensity that is the reference for determining point marker points.

Fig. 8.   Convert Histogram to Threshold

Figure 9   describes the process of positioning point points by matching using the FAST algorithm. A point on threshold has the purpose of determining the number of point points produced. The more point points produced, the better the marker pattern.

Fig. 9.   Point Assignment on Image for Marker

The Process of FAST Algorithm (Features Accelerated Segment Test) Corner Detection begins with the determination of the p point on the coordinate (x_p, y_p) on the image and comparing the

intensity of the p point with the 4 points around them. The first point is located in coordinates (x, y_{p-3}), the second point is located in coordinates (x_{p+3}, y), the third point in coordinates (x, y_{p+3}), and the fourth point at coordinates (x_{p-3}, y).

The *p* point will be the angle when the intensity value is smaller or more significant than the three points around it. The *p* point will be moved to the next position (x_{p+1}, y_p), and the point will be compared to the surrounding 4 points. Proses this up to all points on digital imagery in comparison.

FAST Corner Detection algorithm works on digital imagery with the following steps:

- Specify the *P* point with the starting position (x_p, y_p), As figure 10. Point *P* as the starting position

- Specify 16 pixel points with a radius of 3 pixels from point *P*, Such as Figure 11. determination 16

- The four points are determined, the first point the coordinates (x_p, y_{p+3}), the second coordinate point (x_{p+3}, y_p), the third coordinate point (x_p, y_{p-3}), and the fourth coordinate point (x_{p-3}, y_p). Like figure 12. determination of coordinate points

- Compare the intensity of the center point *P* with the surrounding point. If there are at least three eligible points, the center point *P* is the corner point, as shown in figure 15. comparing the intensity of point *P* :
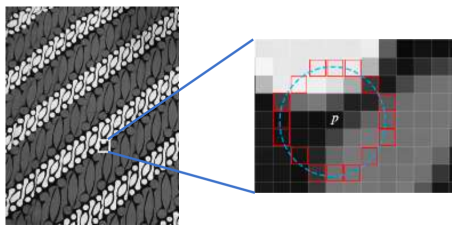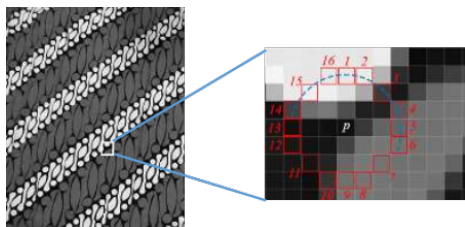

Fig. 10. Point *P* as the starting position
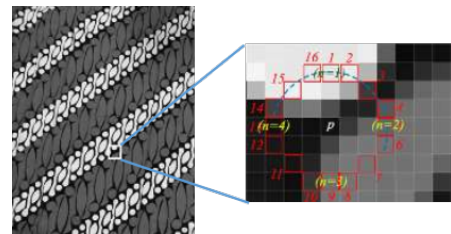

Fig. 11. Determination of 16-pixel points

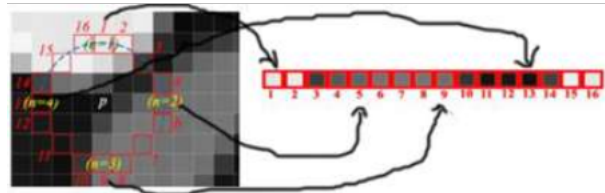Fig. 12. Determination of coordinate points
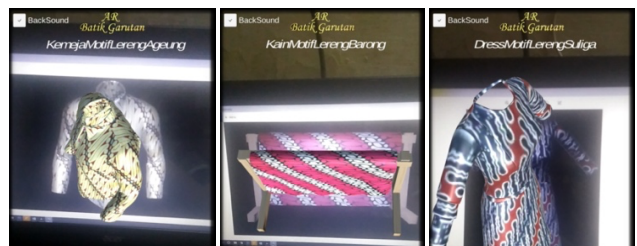

Fig. 13. Comparing the Intensity of point *P*

Fig. 14. The example of a 3D object of Batik Garutan

Illustration of angular detection using FAST algorithm for some Batik Garutan motifs and some types of objects shown in figure 14

C. Test Results Alpha and Betha

The results of Alpha Testing for 3D detection of Batik Garutan objects, within which markers are detected in live time, which is certainly different in each marker.
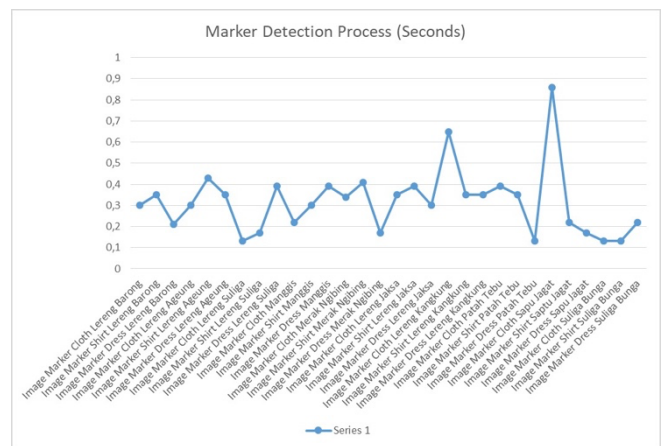

Fig. 15. Alpha 3D Object Test Results on Marker

IV. CONCLUSION

The results of the implementation of the FAST Algorithm on Augmented Reality Batik Garutan introduction on android mobile devices is beneficial, practical, and easy to use. It can be seen from the results of the responses questionnaire online by 42 people, with the average percentage of answers reached 85.94%, which means it falls into the category very well. In the process of detecting Marker with the form of Fabric, Shirt,

and Dress detected in its entirety with different times and can be averaged for the detection time of 0.315 Seconds. This research uses marker-based so it can only be done if there is a marker used, if you want to detect batik other than Batik Garutan then the marker must be recognized first.

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