The Effects of Vertical and Horizontal Distance on The Performance of QR Code Detection System

M L Hakim¹, S Yatmono², A C Nugraha³ and M Khairudin⁴
¹,²,³,⁴ Electrical Engineering Education Dept., Universitas Negeri Yogyakarta, Indonesia
E-mail: luthfihakim93@uny.ac.id

Abstract. The development of image processing science is needed to solve problems that are often faced by humans, especially in the field of computer vision. One application of the image processing system is on a package delivery mission during the Covid-19 pandemic. Drones are used to send packages by detecting the presence of QR code to determine the point of delivery location. In this study, tests will be carried out on the maximum distance (vertical and horizontal) that can be detected by the QR code detection system and the length of time to detect the presence of the QR code (time spent). The test shows that the greater the data collection distance (vertical and horizontal), the longer the system detects the presence of the QR code. The maximum horizontal distance that the QR code can detect is 155 cm, while the vertical distance is 115 cm. The detection distance at vertical is smaller than horizontal because the vertical distance is affected by the field of view (FoV).

1. Introduction

The advancement of digital image processing technology has developed very rapidly. Where these developments will make it easier to help human life in carrying out daily activities. Today there are many applications that can apply it in various fields in the fields of agriculture, food and defense. One example of the use of image processing in the food sector is carried out by Patel, where in his research there are 4 main techniques applied to segmenting food products, namely thresholding, gradient based, region based, and classification based [1].

According to Wiley, image processing is very helpful for researchers in analyzing images and videos to produce the required information and understand information about descriptions or events. In his research method, Wiley uses the multi-range application domain method with massive data analysis. The results of his review categorized image processing into four groups, for example, image processing, object recognition, and machine learning [6].

In agriculture, research has also been carried out using image processing [2] [4], where the research is used to detect estimates of rice yields. This research uses the concept of the acquired image by separating the background object, leaf object, and panicle object.

Research on image processing was also carried out by Mulyawan, by utilizing a webcam to capture images so that it would produce an image of the object. Then the object image will be processed using the template matching method to identify and track the object image. After obtaining the object image image then the next process is to compare it with the database. If it matches the database, the resulting output will be a sound that matches the object image [3].

This research will test the effect of vertical and horizontal distance on QR code by utilizing image processing.
2. Method

Image processing is done using the multi thresholding method. Where the satellite image in the form of a color image (RGB) is converted into a grayscale image. The grayscale image is then repaired through a contrast stretching process, then converted into a binary image. Morphological operations, namely erosion and dilation are applied to the binary image so that the number of object pixels (Qr Code) can be calculated in the image [4]. Figure 1 shows an image processing schematic.

Figure 1. Image processing schematic flow [5]

This research is included in the experimental research category. Data were collected on variations in vertical and horizontal distances. At the initial horizontal distance, the vertical distance and horizontal distance in this data collection are 50 cm and 60 cm, then the horizontal distance is added with a range of 5 cm until the maximum distance the system cannot detect the presence of the Qr Code (Figure 2).

Figure 2. Retrieval of data at horizontal distances

Whereas at the vertical distance, the initial position of this data collection is the vertical distance of 50 cm and the horizontal distance of 125 cm, then the vertical distance is added by the range of 5 cm until the maximum distance the system cannot detect the presence of the Qr Code (Figure 3).

Figure 3. Retrieval of data at a vertical distance
The data collection process for each variation was carried out three times, then the value was averaged. The purpose of data collection is to determine the maximum distance (horizontal and vertical) that can be detected by the Qr Code detection system. In addition, this study also aims to determine the time required by the system to detect the presence of Qr Code.

3. Results and Discussion

The data collection scheme at vertical and horizontal distances can be seen in Figure 4. Data were collected at vertical and horizontal distances. From the data collection, the maximum distance (vertical and horizontal) can be detected by the Qr Code detection system. In addition, you will also get the length of time to detect the presence of the Qr code (time spent).

The results of data collection at horizontal distances show that the farther the data collection distance tends to be the longer the time spent for the drone to detect the presence of Qr Code. At a distance of 155 cm it has the longest detection time, which is 2,035 s, after that distance the presence of the Qr Code is not detected. Figure 5 shows the effect of drone horizontal distance on detection time (time spent) on Qr Code.

![Figure 4. Schematic data collection at vertical and horizontal distances](image)

![Figure 5. Effect of drone horizontal distance on detection time (time spent)](image)

The effect of drone vertical distance on the time spent on detection on the Qr Code can be seen in Figure 6. From this picture shows that the farther the data collection distance tends to be the longer the time...
spent for the drone to detect the presence of the Qr Code. At a distance of 115 cm it has the longest detection time, which is 14,682 s, after that distance the presence of the Qr Code is not detected. It can be seen that at a distance of 100 cm and above it has a longer detection time, this happens because the field of view of the camera used has almost reached its maximum, so the camera cannot fully detect the presence of the Qr Code.

Figure 6. Effect of drone vertical distance on detection time (time spent)

In the vertical distance data collection graph, it can be seen that the time it takes for the drone to detect the presence of the Qr Code is longer than the horizontal distance data, this happens because the vertical distance is influenced by the amount of field of view (FoV) from the camera on the drone.

4. Conclusion

The results of research on The effects of vertical and horizontal distance on the performance of Qr code detection system show that the greater the data collection distance (vertical and horizontal), the longer the system detects the presence of Qr Code. The maximum horizontal distance that the Qr Code can detect is 155 cm, while the vertical distance is 115 cm. The detection distance at vertical is smaller than horizontal because the vertical distance is affected by the field of view (FoV).

References

[1] Patel KK, Khan MA, Kar A, Kumar Y, Bal LM and Sharma DK 2015 International Journal Of Food Quality And Safety 3 p 01-16
[2] Holik A, Bachtiar RR 2019 Jurnal Ilmiah Rekayasa Pertanian dan Biosistem 7(2) p 249-257
[3] Mulyawan H, Samsono MZD, Setiawardhana 2013 Identifikasi dan Tracking Objek Berbasis Image Processing Secara Real Time.
[4] Putri AY and Sumiharto R 2016 Indonesian Journal of Electronics and Instrumentation Systems (IJEIS) 6(2) pp. 187–198
[5] Nur MF, Dwiyanti Y and Aprizal M 2017 Seminar Nasional Penginderaan Jauh ke-4 p 187-190
[6] Wiley V and Lucas T 2018 International Journal Of Artificial Intelliengce Research 2(1) pp. 28-36