Pi Camera Distance Effect on Face Recognition

Yusuf Ari Bahtiar[1], Oni Yuliani[2], Arif Basuki[3], Iyus Rusmana[4]

[1,2,3,4] Electrical Engineering, Industry Technology Faculty, Institut Teknologi Nasional Yogyakarta, Indonesia.

*Corresponding Author: Yusuf Ari Bahtiar, Electrical Engineering, Industry Technology Faculty, Institut Teknologi Nasional Yogyakarta, Indonesia.

Abstract:

Face recognition is biometric technology has been awesome and popular in this century. Not only as an identification of a, it can can be used as a medium to secure the privacy data of companies and related agencies, even for someone's personal room. Various types have developed more precisely, either directly using laptops or embedded systems. Raspberry Pi is embedded medium with Picamera is able to detect the presence of a person in a determined area. The algorithm used is haarcascade with a combination of histogram of oriented gradient as database encoding. The database containing the vector of each sample from the respondent will be compared with realtime picamera capture. As a result, faces can be recognized as objects and according to the owner's name. The placement of objects varies from 0.5 meters to 3 meters. Light intensity also given effect on detection process. The highest level of compatibility occurs during the day with lux of such a size.

Keywords: Image Processing, Face Recognition, Camera Distance, Light Intensity, Raspberry Pi

Introduction

Everyone Need a Secure

The main system for an attendance has become the main requirement in predicting experience and salary in university, institutions and other related agencies. The accuracy of the face recognition as a distinguishing feature of each person is the reason for the development of the goal project [1]. Apart from detecting the presence of faces, the image processing uses in environment technology which is also used by Dedy *et al* as the detection of smart littering objects, namely the monitoring of littering garbage, where lighting greatly affects the accuracy of the detected object, in this study the webcame camera cannot monitor objects with a distance less than 1.2 meters [6]. Meanwhile, the image processing can also be applied to minimarkets security for seeing the presence of visitors who was carrying sharp weapons [4]. The figure is obtained from CCTV using the Haarcascade

algorithm to find objects. Then the object is sent to the main system and activates the SMS Gateway module to send notifications to the manager [3], so precautions are taken that it can make visitors comfortable.

According to Criyus *et al*, facial recognition is able to provide open and close access to private room, only the owner can enter the room, this is intended to save data or privacy from the owner [8] [9]. Meanwhile, according to Ihsan *et al*, in research on objects, each distance has a different character and result, the farther the object is the less it can be detected. The best results use a detection scale factor of 1.1 with a neigborhood parameter of 3 value [4].

The pi camera only has 5 MP, but is able to monitor the presence of faces in predetermined areas and a recognition person. Pi cameras are also greatly affected by the presence of sunlight / other lighting [5]. Not infrequently silhouettes occur and make undetected objects found. According to Tung et al, images captured through a

network of cameras, both CCTV and other cameras, show that there is a difference in the accuracy of object detection during the day and night, so as to optimize the program from computer vision [5]. This research focuses on the detection of objects using a picamera with a height of 0.8 meters from the floor, objects located between 0 meters to 3 meters with different lighting conditions, namely morning, afternoon, and evening.

Methods

The experimental method requires measuring the intensity of the sun's lighting on a home page which is measured using a light meter, the computation processing media used is the Raspberry Pi Model B which has been integrated with Picamera and several libraries that have been successfully installed, such as dlib, imutils, and face recognition. variations in objects are the main target for the presence or absence of objects and successfully recognizing the owner of the face or not. In addition, the variation of the detection distance from the front of the camera to the maximum of the camera can detect the presence of a face position and match the existing name in the database.

Pi Camera

The Pi camera has connected to the Raspberry Pi module via the CSI slot. Has a 5MP capacity that is able to explore around the area by detecting every object encountered. Installation of the pi camera uses a bracket that is placed upright, so that it can be used without holding the camera at all times [10]. The picamera used is shown in the Figure 1.

Figure1. Pi camera

Specification	
Max Resolution	5MP
Focus Type	Non-autofocus
Lens Technology	1080p
Internal Microphone	-
Cable	CSI

Raspberry Pi 3 Model B

Raspberry is one of the popular mini computers and is used by students to create a final project, it is even used as security surveillance which is capable of processing high computational data, such as image processing. The use of the Raspberry Pi quickly heats up for image processing, but it can be tricked by providing a fan as a cooling medium for the machine, has 1 GB RAM with a 64MHz quad-core CPU, can be used for everyday administration and office purposes. In addition, the 5 Volt 2 Amp power supply makes it easy for users to find new parts if there is damage, by changing the power supply using a cellphone charger. The presence of a GPIO pin can be used as an input medium for a situation connected to a sensor or output to an actuator [1] [6].

Figure 2. Raspberry Pi Model 3 B [6]

Light Meter

Light meter is used to measure and estimate the light intensity both indoors and outdoors. Having a white round sensor as a part that is sensitive to light, the value interval can be adjusted according to the lighting conditions being observed. It is from this tool that the good lighting values for the Picamera can be identified and implemented [6].

Figure 3. Light meter LX used in this experiment to estimate a large amount of sun intensity

Camera Bracket

Picamera cannot upright stand alone, because it only has a cable as a connector to the CSI slot, it is necessary to add a spacer to strengthen the bracket that has been embedded in the pi camera. In addition, it is attached to the raspberry pi to make it simpler and easier to carry anywhere following the availability of electricity.

Figure 4. Picamera and its bracket

Table2. Detection Distance in the Afternoon (1 PM)

Distance (meter)	Pi Camera Detection
< 0,5	Undetected
0,50 – 1,00	High
1,01 – 2,00	Medium
2,01 – 3,00	Low
> 3,00	Undetected

In the next section, pi camera will display the captured image in each condition with almost the same distance. The difference in detection is shown in

Result and Discussion

Distance Detection of Camera

The Pi camera has been successfully detected the presence of a face and recognized the owner's name. In this experiment, variations in the location of the object also influenced success. Table 1 shows the range of distances that the picamera can recognize as a face match according to the lighting conditions in the morning.

Table1. Detection distance of camera in the Morning (10 AM)

Distance (meter)	Pi Camera Detection
< 0,5	Undetected
0,50 – 1,00	High
1,01 – 2,00	Medium
2,01 – 2,90	Low
> 2,90	Undetected

Table3. Detection Distance in the Evening (4 PM)

Distance (meter)	Pi Camera Detection
< 0,5	Undetected
0,50 – 1,00	High
1,01 – 2,00	Medium
2,01 – 2,75	Low
> 2,75	Undetected

Figure 5, of the three images it shows that during the day the face recognition range is longer than the others.
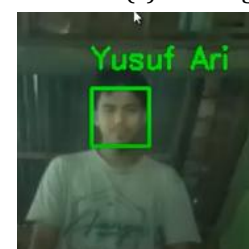

(a)　　　　(b)　　　　(c)

Figure5. Object position at 3 meter from picamera, (a) Morning (b) Afternoon (c) Evening
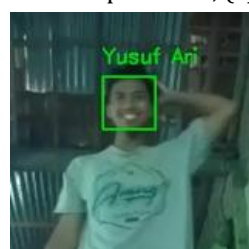
(a)　　　　(b)　　　　(c)

Figure6. Object position at 2,5 meter from picamera (a) Morning (b) Afternoon (c) Evening
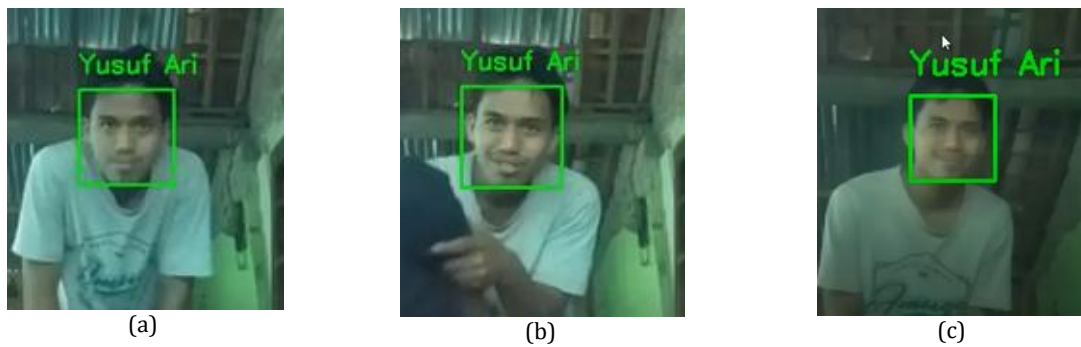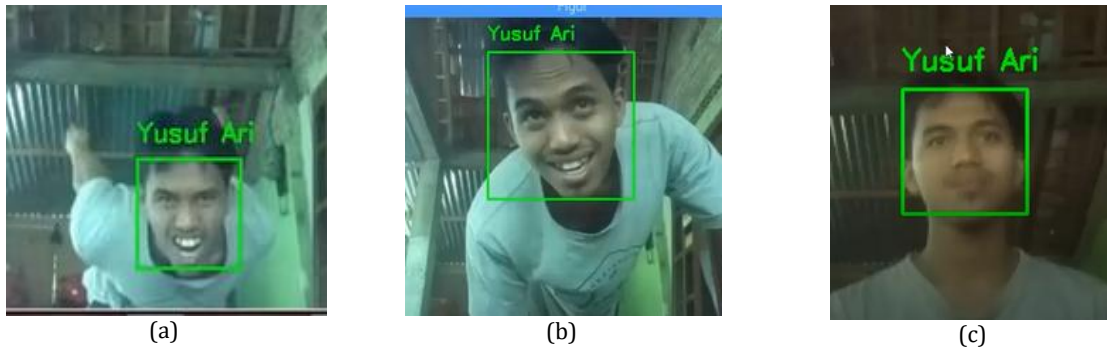
Figure7. Object position at 2 meter from picamera (a) Morning (b) Afternoon (c) Evening

Figure8. Object position at 1,55 meter from picamera (a) Morning (b) Afternoon (c) Evening
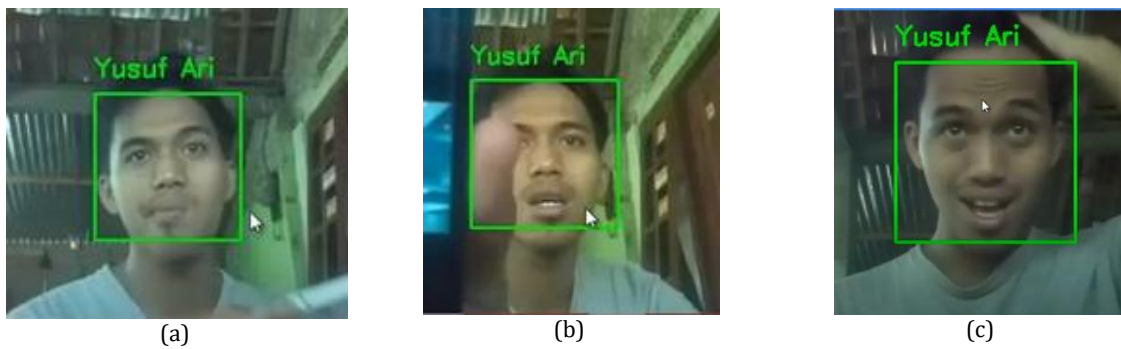

Figure9. Object position at 1 meter from picamera (a) Morning (b) Afternoon (c) Evening
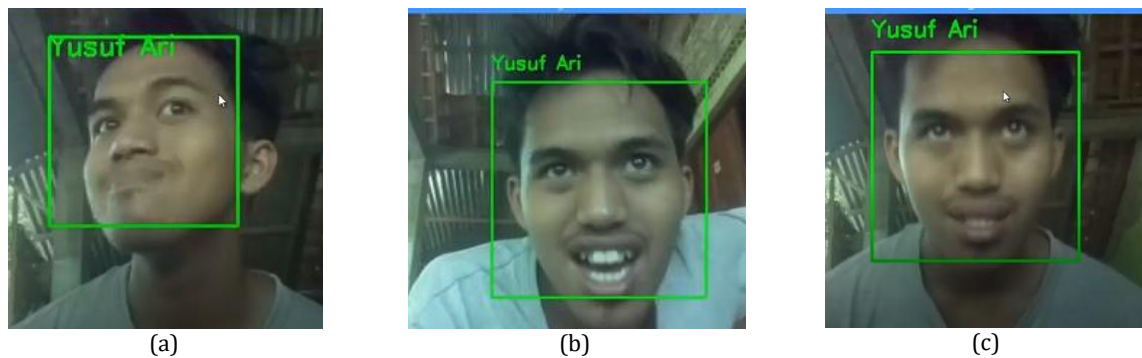

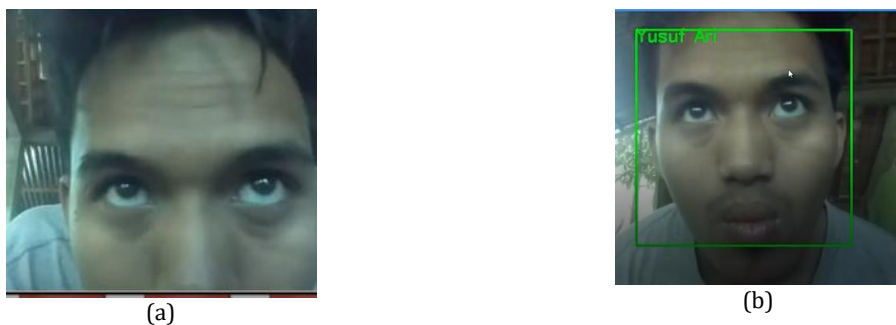**Figure10.** Object position at 0,5 meter from picamera (a) Morning (b) Afternoon (c) Evening

Figure11. Object position at least from 0,5 meter from picamera (a) Morning (b) Afternoon

So, we was shared the measure of light intensity of sun in Tabel 4

Table 4. Detection Light Intensity or Lux from Sun that Effect Camera with Distance 1 – 3 meters

Day	Time	Lux of height = 0.8 meter on chair	Lux of height = 0.8 meter on yard
Morning	10 AM	99,4	1825
Afternoon	1 PM	109	3708
Evening	4 PM	93,7	1122

Conclusion

Based on the results of experiments, face recognition using a Picamera that connected to the Raspberry Pi has been successfully carried out. Picamera's ability to detect objects is able to reach an area of 3 meters for the daytime, while in the morning and evening it is different according to the conditions of the sun's lighting intensity.

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