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To cite this article: T H Nasution *et al* 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **851** 012034

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Analysis of the use of CMUcam5 Pixy camera in wheeled soccer robots

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Abstract. Wheeled soccer robot is a robot that can play football like humans but maneuvers using wheels. Wheeled soccer robot has an event that is held routinely every year in Indonesia, namely in the Indonesian Robot Contest. To play well, the robot is certainly equipped with sensors and actuators that are qualified. One of the sensors used is the camera. The camera on the soccer robot functions to capture images around the robot that will later be processed on a computer. In this study, we analyzed the use of CMUcam5 Pixy for wheeled soccer robots. testing is carried out as much as 2 stages, namely testing without noise and testing with noise. From the results of tests that have been carried out, the CMUcam5 Pixy camera has a certain limit for detecting the ball. In testing with CMUcam5 Pixy camera noise can only detect up to 490 cm. Whereas in testing with CMUcam5 Pixy camera noise can only detect up to 420 cm.

1. Introduction

Wheeled soccer robot is a robot that can play football like humans but maneuvers using wheels. Wheeled soccer robot has an event that is held routinely every year in Indonesia, namely in the Indonesian Robot Contest. Indonesian Robot Contest has 5 branches of games, namely: Abu Robocon Indonesian Robot Contest, Indonesian Fire Extinguisher Robot Contest, Indonesian Humanoid Football Robot Contest, Indonesian Wheeled Robot Soccer Contest, Indonesian Dance Robot Contest[1]. Among these 5 branches, soccer robots can be included in the Wheeled Robot Soccer Contest branch.

To play well, the robot is certainly equipped with sensors and actuators that are qualified[2]. One of the sensors used is the camera. The camera on the soccer robot functions to capture images around the robot that will later be processed on a computer. The processed image will produce output in the form of objects that have been segmented from other objects. This segmented object will be created as a reference for the movement or activity that will be carried out by the robot.

The practical technology commonly used to insert cameras into robots is CMUcam5 Pixy to detect ball objects[3,4]. CMUcam5 Pixy is equipped with a Graphic User Interface that makes it easy to select objects to track. It also has firmware from the developer so that it can be operated easily even for beginners. In this study, we will analyze the use of CMUcam5 Pixy for wheeled soccer robots.

2. Methods

2.1. Research procedure



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The first step of this research is the study of literature based on existing research. We did some research literacy about soccer competitions[5–8]. this research is also based on our previous research and several other researchers about image processing[9–11]. Then proceed to the testing stage using a CMUcam5 Pixy camera.

The flow of the test can be seen in Figure 1. Based on Figure 1, the first step carried out in the system design is to prepare objects in the form of futsal balls. Because the authors found it difficult to find an orange futsal ball in accordance with the rules of the competition in the Indonesian Wheeled Robot Soccer Competition in the market, the futsal ball was replaced with red. The colored futsal balls that were replaced did not cause significant problems in this study. Furthermore, testing is carried out as much as 2 stages, namely testing without noise and testing with noise.

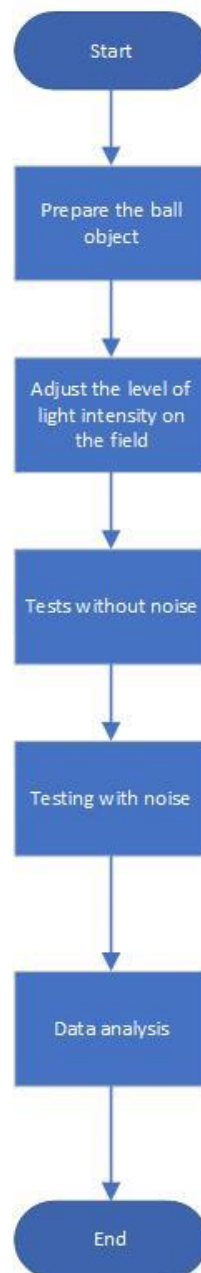


Figure 1. Stages of testing

2.2. Testing

The testing place is done indoors with enough light intensity. The testing site is carried out on a green carpet that has been formed into a wheeled soccer robot match field by the rules of the Wheeled Soccer Robot Contest. The test will be carried out by looking at the detection results with the CmuCam 5 Pixy camera module which already has firmware that can detect colors through a GUI (Graphical User Interface). Pixel 5 Pixy will be calibrated by entering the orange ball signature that will be used. CmuCam 5 Pixy configuration can be seen in Figure 2.

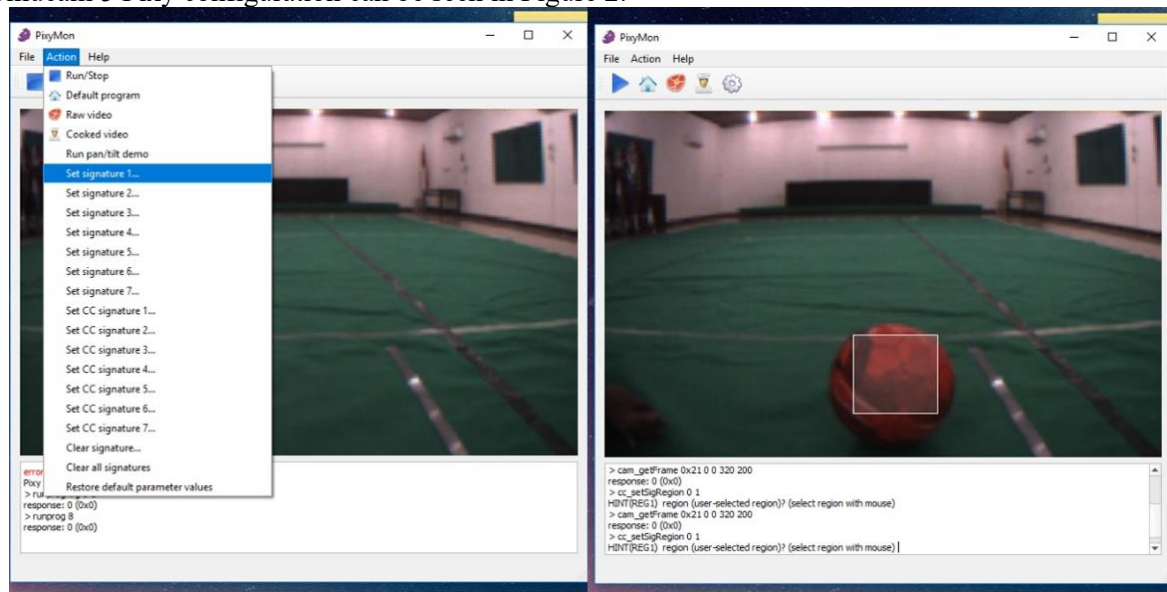


Figure 2. Configuring a CMUcam5 Pixy camera

After the object to be has been prepared, the next step is to adjust the test environment. The thing to note is the level of intensity that is given in the testing room. This is so that testing can be done with valid conditions in accordance with the conditions listed in the Wheeled Robot Soccer Competition rules. The intensity of the light will also affect the quality of tracking on objects and therefore, testing will be done indoors (indoor).

The intensity of the light provided in the room must be bright enough so that the image can be seen clearly to the end of the room or the test field. In the testing room, light from the sun is not arranged to enter the room so that the light intensity from outside the testing room does not interfere during the testing process. This is because the light from outside the room will continue to change along with the process of testing. Light from outside which changes the intensity of light in the room will also change the calibration process that will be done.

After the configuration of CmuCam 5 Pixy is finished, the layer of Cooked Video in the Pixymon software will display the output in the form of objects that have been marked with a box that says the signatures. The output of CmuCam 5 Pixy can be seen in Figure 3.

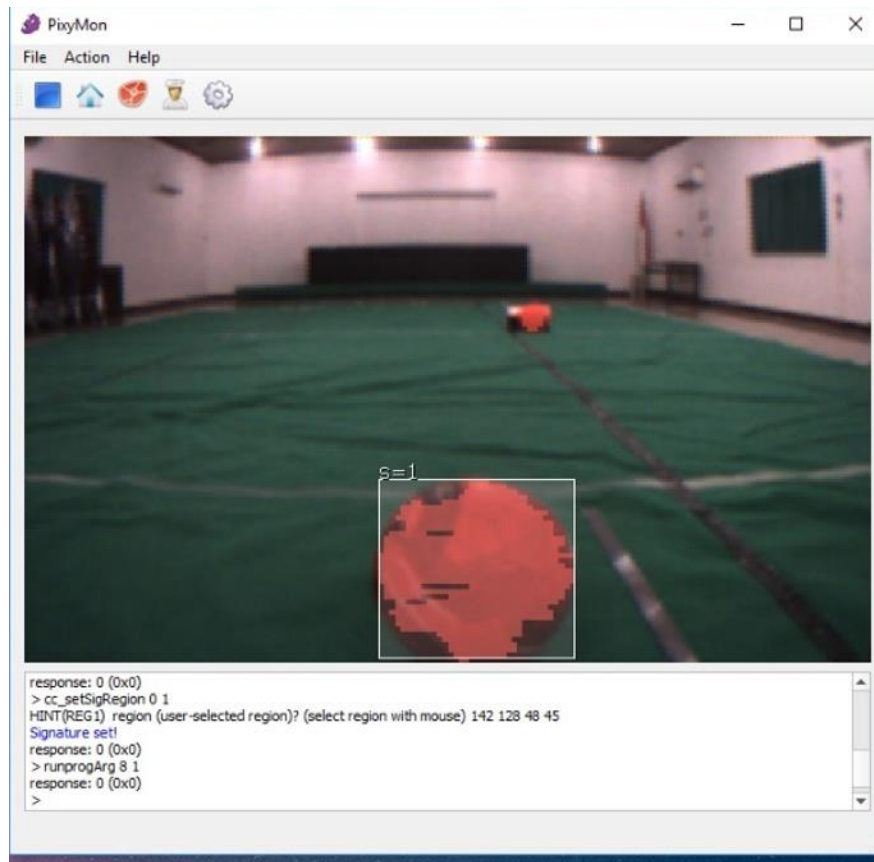


Figure 3. Display layer from Pixymon software output after configuration

3. Results and discussion

The first test was carried out 15 times without noise testing with distances ranging from 50 cm to 550 cm. Data from the test results can be seen in table 1. From the test results the CMUcam5 Pixy camera can only detect balls up to 490 cm.

Table 1. Tests without noise

Distance (cm)	Results
50	Detected
100	Detected
150	Detected
200	Detected
250	Detected
300	Detected
350	Detected
400	Detected
450	Detected
460	Detected
470	Detected
480	Detected
490	Detected
500	Not Detected
550	Not Detected

Furthermore, the experiment was conducted using 15 times of noise from 50 cm to 450 cm. The test results can be seen in Table 2. From Table 2 it appears that the CMUcam camera can only detect up to 420 cm.

Table 2. Tests with noise	
Distance (cm)	Results
50	Detected
100	Detected
150	Detected
200	Detected
250	Detected
300	Detected
350	Detected
400	Detected
410	Detected
420	Detected
430	Not Detected
440	Not Detected
450	Not Detected
500	Not Detected
550	Not Detected
600	Not Detected
650	Not Detected
700	Not Detected

4. Conclusion

From the results of tests that have been carried out, the CMUcam5 Pixy camera has a certain limit for detecting the ball. In testing with CMUcam5 Pixy camera noise can only detect up to 490 cm. Whereas in testing with CMUcam5 Pixy camera noise can only detect up to 420 cm.

Acknowledgment

We thank the Ministry of Education and Culture and Universitas Sumatera Utara for supporting the implementation of this research.

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