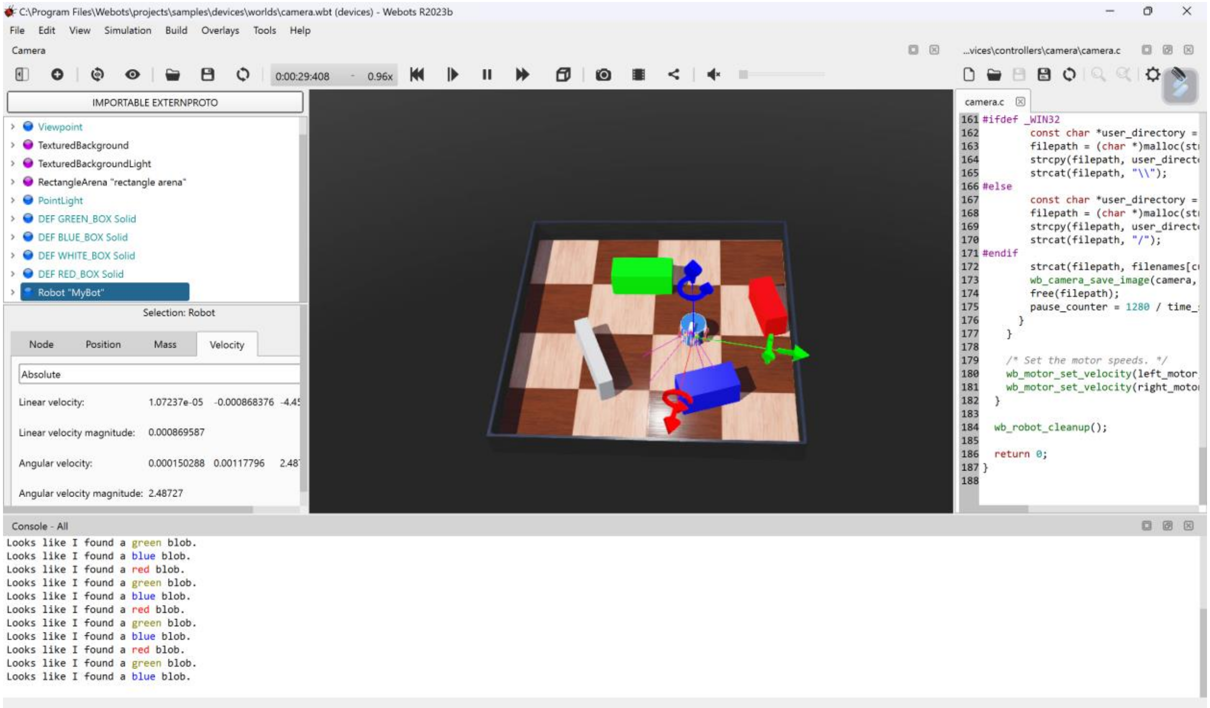
Cholasih Ryan Maulana/1103213043



Absolute

Linear velocity: 1.07237e-05 -0.000868376 -4.45

Linear velocity magnitude: 0.000869587

Angular velocity: 0.000150288 0.00117796 2.48

Angular velocity magnitude: 2.48727

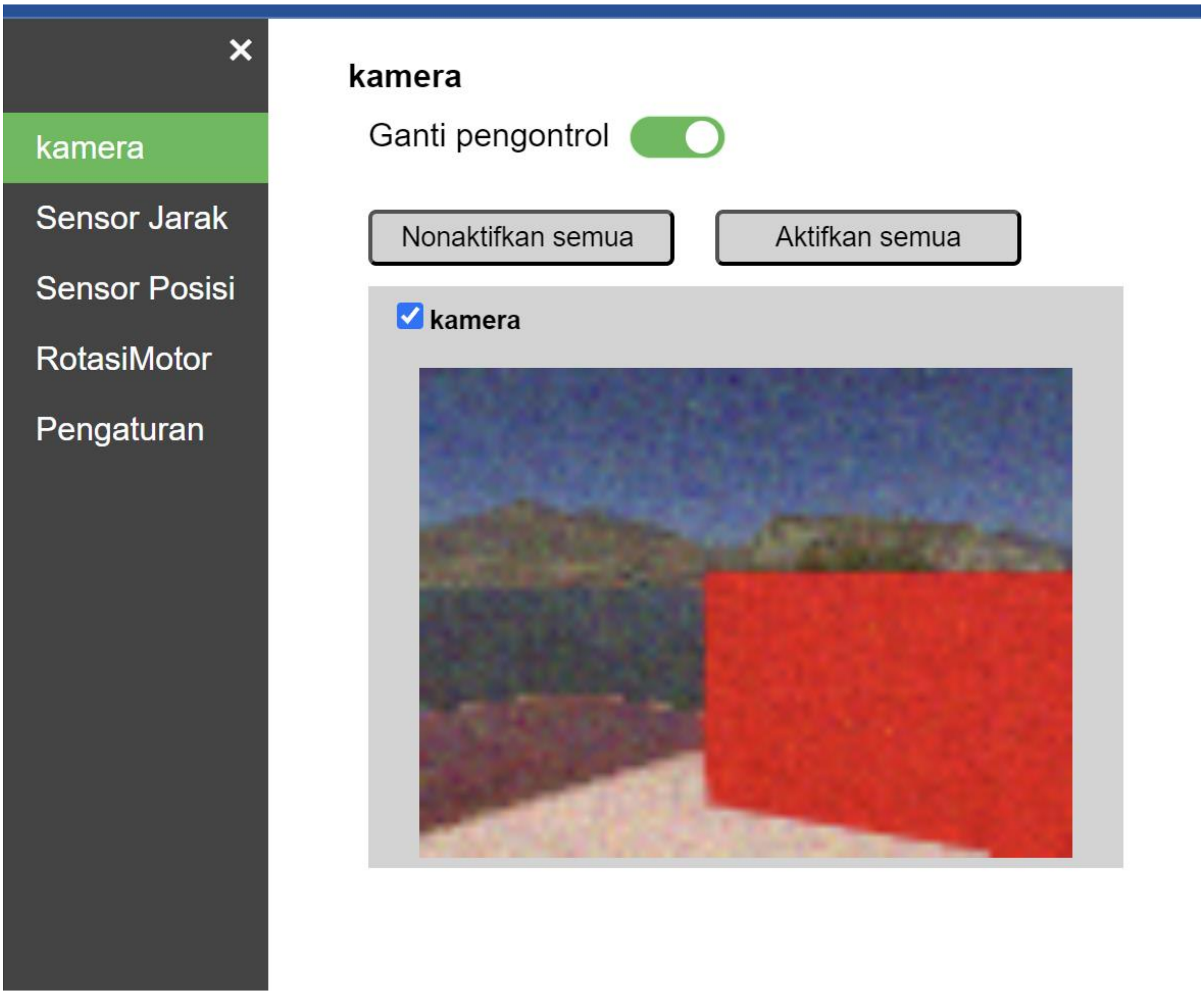
```
#ifdef _WIN32
        const char *user_directory =
        filepath = (char *)malloc(st
        strcpy(filepath, user_direct
        strcat(filepath, "\\");
#else
        const char *user_directory =
        filepath = (char *)malloc(st
        strcpy(filepath, user_direct
        strcat(filepath, "/");
#endif
        strcat(filepath, filenames[c
        wb_camera_save_image(camera,
        free(filepath);
        pause_counter = 1280 / time_
      }
    }

    /* Set the motor speeds. */
    wb_motor_set_velocity(left_motor
    wb_motor_set_velocity(right_moto
  }

  wb_robot_cleanup();

  return 0;
}
```

```
Looks like I found a green blob.
Looks like I found a blue blob.
Looks like I found a red blob.
Looks like I found a green blob.
Looks like I found a blue blob.
Looks like I found a red blob.
Looks like I found a green blob.
Looks like I found a blue blob.
Looks like I found a red blob.
Looks like I found a green blob.
Looks like I found a blue blob.
```



Simulasi di atas memiliki fungsi untuk mengidentifikasi warna yang telah ditangkap oleh kamera serta memberikan output di log terminal. Berikut merupakan Source Code :

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Source code

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <webots/camera.h>
#include <webots/motor.h>
#include <webots/robot.h>
#include <webots/utils/system.h>

#define ANSI_COLOR_RED "\x1b[31m"
#define ANSI_COLOR_GREEN "\x1b[32m"
#define ANSI_COLOR_YELLOW "\x1b[33m"
#define ANSI_COLOR_BLUE "\x1b[34m"
#define ANSI_COLOR_MAGENTA "\x1b[35m"
#define ANSI_COLOR_CYAN "\x1b[36m"
#define ANSI_COLOR_RESET "\x1b[0m"

#define SPEED 4
enum BLOB_TYPE { RED, GREEN, BLUE, NONE }; //menentukan tipe warna yang dideteksi

int main() {
  WbDeviceTag camera, left_motor, right_motor; //menetukan jalannya arah robot
  int width, height;
  int pause_counter = 0;
  int left_speed, right_speed;
  int i, j;
  int red, blue, green;
  const char *color_names[3] = {"red", "green", "blue"}; //var array untuk menetukan output warna
  const char *ansi_colors[3] = {ANSI_COLOR_RED, ANSI_COLOR_GREEN, ANSI_COLOR_BLUE};
  const char *filenames[3] = {"red_blob.png", "green_blob.png", "blue_blob.png"};
  enum BLOB_TYPE current_blob;

  wb_robot_init();

  const int time_step = wb_robot_get_basic_time_step(); //waktu clock dari robot

  /* Get the camera device, enable it, and store its width and height */
  camera = wb_robot_get_device("camera");
  wb_camera_enable(camera, time_step);
  width = wb_camera_get_width(camera);
  height = wb_camera_get_height(camera);

  /* get a handler to the motors and set target position to infinity (speed control). */
  left_motor = wb_robot_get_device("left wheel motor");
  right_motor = wb_robot_get_device("right wheel motor");
  wb_motor_set_position(left_motor, INFINITY);
  wb_motor_set_position(right_motor, INFINITY);
  wb_motor_set_velocity(left_motor, 0.0);
  wb_motor_set_velocity(right_motor, 0.0);

  /* Main loop */
  while (wb_robot_step(time_step) != -1) {
    /* Get the new camera values */
    const unsigned char *image = wb_camera_get_image(camera);

    /* Decrement the pause_counter */
    if (pause_counter > 0)
      pause_counter--;
```

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```
/*
 * Case 1
 * A blob was found recently
 * The robot waits in front of it until pause_counter
 * is decremented enough
 */
if (pause_counter > 640 / time_step) {
  left_speed = 0;
  right_speed = 0;
}
/*
 * Case 2
 * A blob was found quite recently
 * The robot begins to turn but don't analyse the image for a while,
 * otherwise the same blob would be found again
 */
else if (pause_counter > 0) {
  left_speed = -SPEED;
  right_speed = SPEED;
}
/*
 * Case 3
 * The robot turns and analyse the camera image in order
 * to find a new blob
 */
else if (!image) {  // image may be NULL if Robot.synchronization is FALSE
  left_speed = 0;
  right_speed = 0;
} else {  // pause_counter == 0
```

```
/* Reset the sums */
red = 0;
green = 0;
blue = 0;

/*
 * Here we analyse the image from the camera. The goal is to detect a
 * blob (a spot of color) of a defined color in the middle of our
 * screen.
 * In order to achieve that we simply parse the image pixels of the
 * center of the image, and sum the color components individually
 */
for (i = width / 3; i < 2 * width / 3; i++) {
  for (j = height / 2; j < 3 * height / 4; j++) {
    red += wb_camera_image_get_red(image, width, i, j);
    blue += wb_camera_image_get_blue(image, width, i, j);
    green += wb_camera_image_get_green(image, width, i, j);
  }
}

/*
 * If a component is much more represented than the other ones,
 * a blob is detected
 */
if ((red > 3 * green) && (red > 3 * blue))
  current_blob = RED;
else if ((green > 3 * red) && (green > 3 * blue))
  current_blob = GREEN;
else if ((blue > 3 * red) && (blue > 3 * green))
  current_blob = BLUE;
```

```
      else
        current_blob = NONE;


      /*
       * Case 3a
       * No blob is detected
       * the robot continues to turn
       */
      if (current_blob == NONE) {
        left_speed = -SPEED;
        right_speed = SPEED;
      }
      /*
       * Case 3b
       * A blob is detected
       * the robot stops, stores the image, and changes its state
       */
      else {
        left_speed = 0;
        right_speed = 0;
        printf("Looks like I found a %s%s%s blob.\n", ansi_colors[current_blob],
color_names[current_blob], ANSI_COLOR_RESET);
        // compute the file path in the user directory
        char *filepath;
#ifdef _WIN32
        const char *user_directory =
wbu_system_short_path(wbu_system_getenv("USERPROFILE"));
        filepath = (char *)malloc(strlen(user_directory) + 16);
        strcpy(filepath, user_directory);
        strcat(filepath, "\\");
#else
```

```
        const char *user_directory = wbu_system_getenv("HOME");
        filepath = (char *)malloc(strlen(user_directory) + 16);
        strcpy(filepath, user_directory);
        strcat(filepath, "/");
#endif
        strcat(filepath, filenames[current_blob]);
        wb_camera_save_image(camera, filepath, 100);
        free(filepath);
        pause_counter = 1280 / time_step;
      }
    }

    /* Set the motor speeds. */
    wb_motor_set_velocity(left_motor, left_speed);
    wb_motor_set_velocity(right_motor, right_speed);
  }

  wb_robot_cleanup();

  return 0;
}
```

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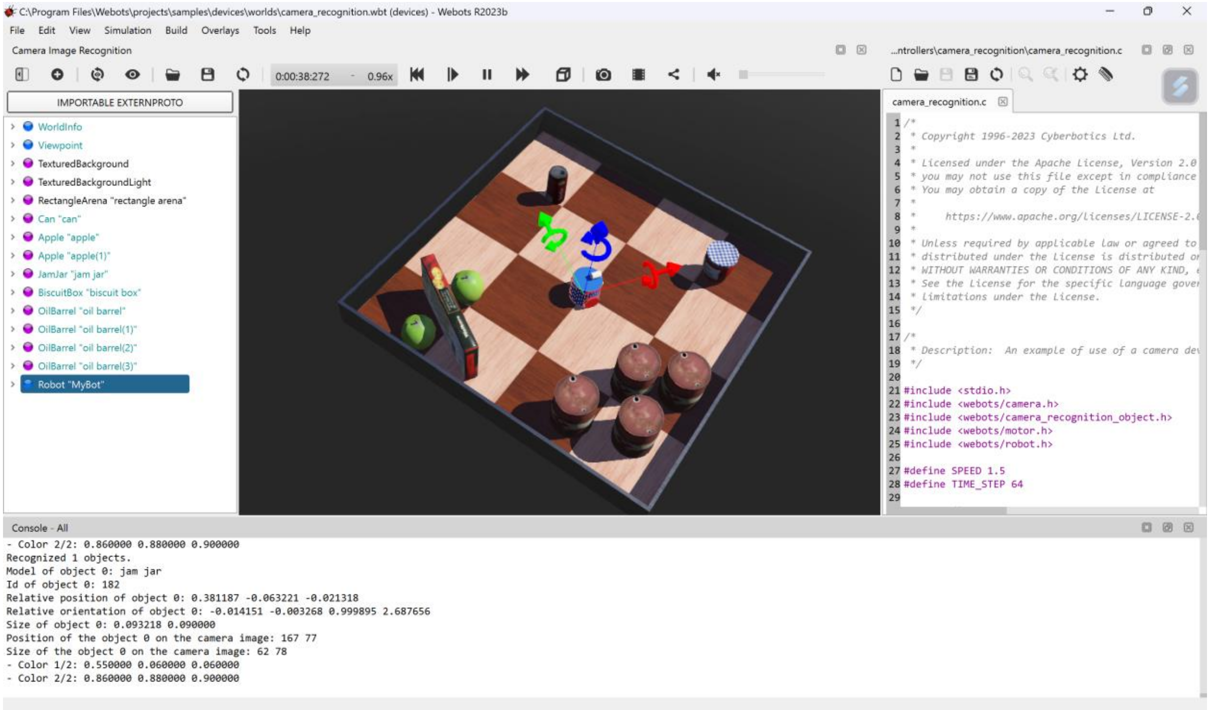
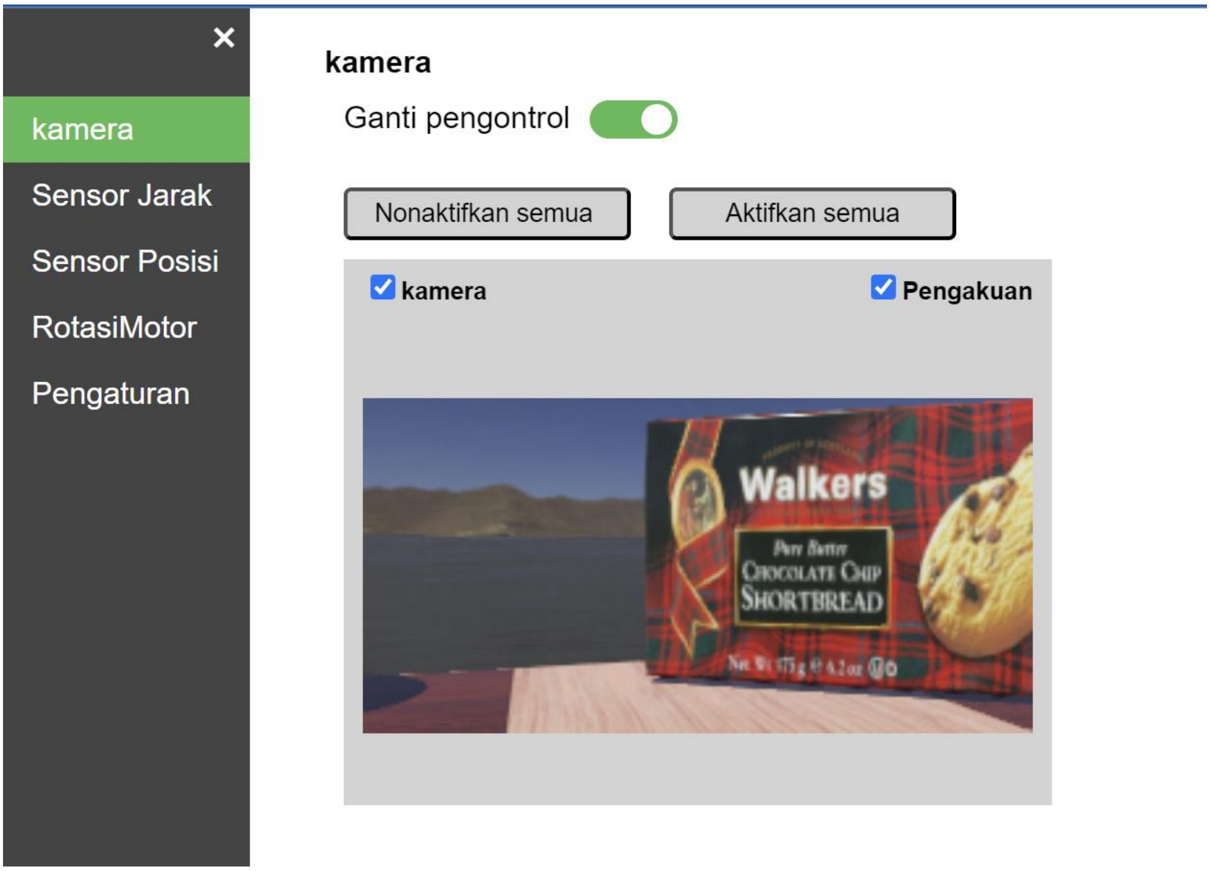

C:\Program Files\Webots\projects\samples\devices\worlds\camera_recognition.wbt (devices) - Webots R2023b
File Edit View Simulation Build Overlays Tools Help
Camera Image Recognition
0:00:38:272
0.96x
IMPORTABLE EXTERNPROTO
WorldInfo
Viewpoint
TexturedBackground
TexturedBackgroundLight
RectangleArena "rectangle arena"
Can "can"
Apple "apple"
Apple "apple(1)"
JamJar "jam jar"
BiscuitBox "biscuit box"
OilBarrel "oil barrel"
OilBarrel "oil barrel(1)"
OilBarrel "oil barrel(2)"
OilBarrel "oil barrel(3)"
Robot "MyBot"
...ntrollers\camera_recognition\camera_recognition.c
camera_recognition.c
Console - All

```
/*
 * Copyright 1996-2023 Cyberbotics Ltd.
 *
 * Licensed under the Apache License, Version 2.0
 * you may not use this file except in compliance
 * You may obtain a copy of the License at
 *
 *     https://www.apache.org/licenses/LICENSE-2.
 *
 * Unless required by applicable law or agreed to
 * distributed under the License is distributed or
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
 * See the License for the specific language gover
 * limitations under the License.
 */

/*
 * Description:  An example of use of a camera de
 */

#include <stdio.h>
#include <webots/camera.h>
#include <webots/camera_recognition_object.h>
#include <webots/motor.h>
#include <webots/robot.h>

#define SPEED 1.5
#define TIME_STEP 64

```

```
- Color 2/2: 0.860000 0.880000 0.900000
Recognized 1 objects.
Model of object 0: jam jar
Id of object 0: 182
Relative position of object 0: 0.381187 -0.063221 -0.021318
Relative orientation of object 0: -0.014151 -0.003268 0.999895 2.687656
Size of object 0: 0.093218 0.090000
Position of the object 0 on the camera image: 167 77
Size of the object 0 on the camera image: 62 78
- Color 1/2: 0.550000 0.060000 0.060000
- Color 2/2: 0.860000 0.880000 0.900000
```



Simulasi robot diatas memiliki fungsi untuk mendeteksi objek yang ada didepannya pada saat kamera mendeteksi objek tersebut. Data yang ditangkap pada objek sudah ada di library dan sudah dimasukkan. Berikut merupakan source codenya :

```
#include <stdio.h>
```

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```
#include <webots/camera.h>
#include <webots/camera_recognition_object.h>
#include <webots/motor.h>
#include <webots/robot.h>

#define SPEED 1.5
#define TIME_STEP 64
```