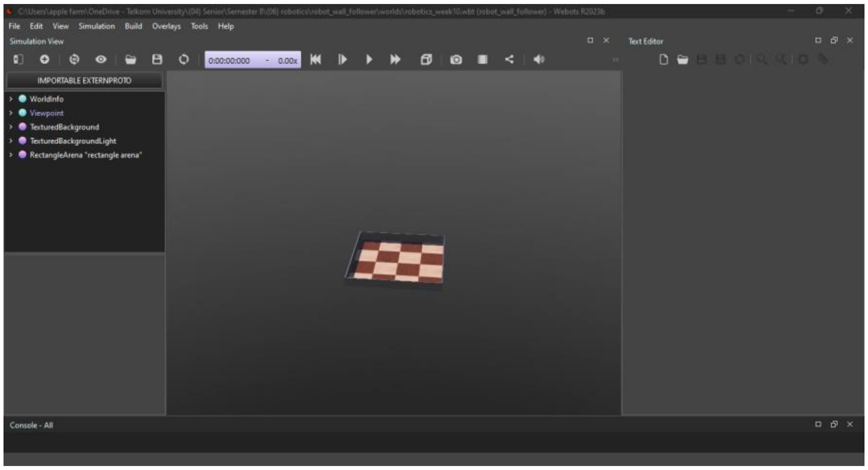
Tugas Week 10 Robotika

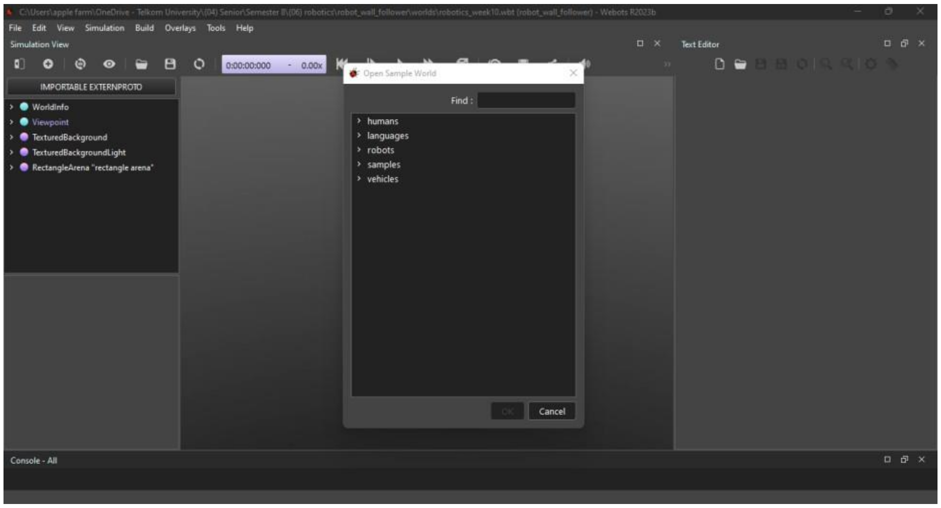
Simulasi Robot dengan Kamera di *Webots*

Percobaan Pertama:

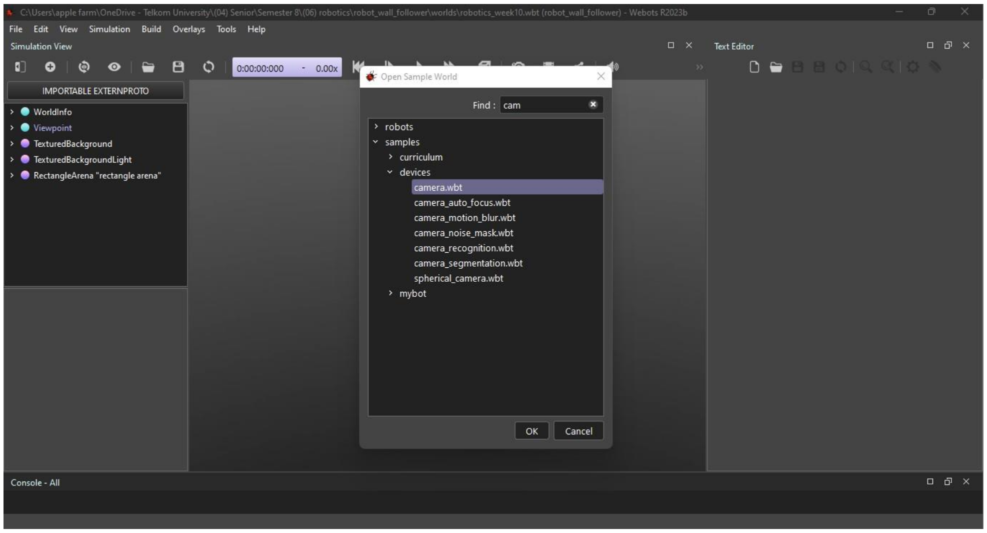
(1) Buka aplikasi Webots dan bikin file baru.


C:\Users\apple farm\OneDrive - Telkom University\(04) Senior\Semester 8\(06) robotics\robot_wall_follower\worlds\robotics_week10.wbt (robot_wall_follower) - Webots R2023b
File
Edit
View
Simulation
Build
Overlays
Tools
Help
Simulation View
0:00:00:000 - 0.00x
Text Editor
IMPORTABLE EXTERNPROTO
WorldInfo
Viewpoint
TexturedBackground
TexturedBackgroundLight
RectangleArena "rectangle arena"
Console - All

(2) Klik tab file lalu pilih *Open Sample World*,

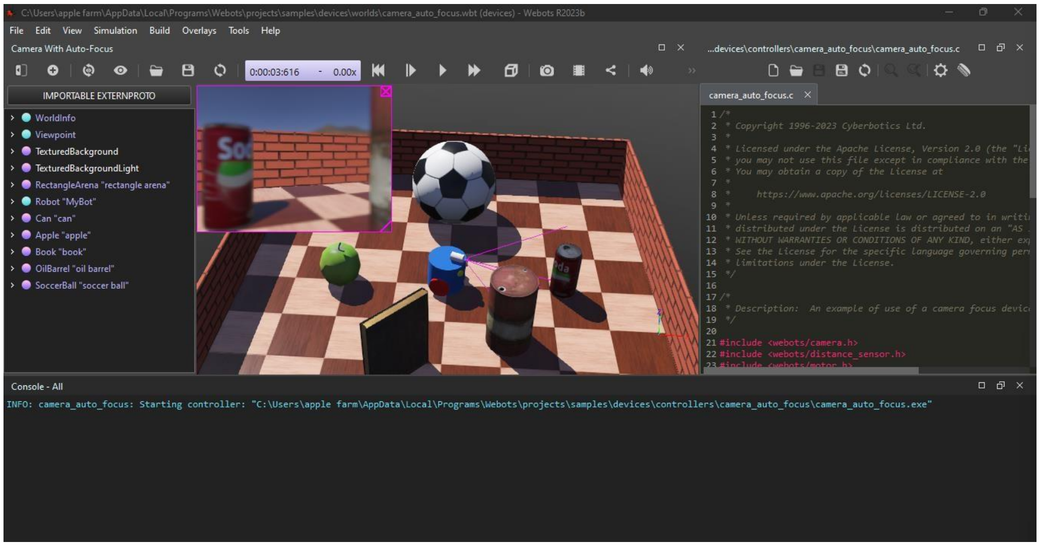


(3) lalu ketik “Camera” di kolom Pencarian. Klik samples lalu devices.



Find : cam

(4) Untuk pertama saya memilih camera_auto_focus, yaitu Camera robot dengan fokus kamera berdasarkan objek yang ada di depannya.


C:\Users\apple farm\AppData\Local\Programs\Webots\projects\samples\devices\worlds\camera_auto_focus.wbt (devices) - Webots R2023b
File Edit View Simulation Build Overlays Tools Help
Camera With Auto-Focus
0:00:03:616 - 0.00x
...devices\controllers\camera_auto_focus\camera_auto_focus.c
IMPORTABLE EXTERNPROTO
WorldInfo
Viewpoint
TexturedBackground
TexturedBackgroundLight
RectangleArena "rectangle arena"
Robot "MyBot"
Can "can"
Apple "apple"
Book "book"
OilBarrel "oil barrel"
SoccerBall "soccer ball"
camera_auto_focus.c
Console - All

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

/*
 * Description:  An example of use of a camera focus devic
 */

#include <webots/camera.h>
#include <webots/distance_sensor.h>
#include <webots/motor.h>
```

```
INFO: camera_auto_focus: Starting controller: "C:\Users\apple farm\AppData\Local\Programs\Webots\projects\samples\devices\controllers\camera_auto_focus\camera_auto_focus.exe"
```

Penjelasan:

Dalam simulator Webots, fitur **camera_auto_focus** memungkinkan kamera untuk secara otomatis menyesuaikan fokusnya guna mendapatkan gambar yang tajam dari objek dengan jarak yang bervariasi dari kamera. Fitur auto focus ini sangat bermanfaat dalam simulasi yang melibatkan kamera pada robot yang bergerak atau dalam lingkungan di mana jarak objek dapat berubah secara dinamis. Dengan fitur ini, kamera dapat terus mempertahankan ketajaman gambar tanpa perlu penyesuaian manual, sehingga meningkatkan akurasi dan efisiensi pengamatan dalam simulasi robotik.

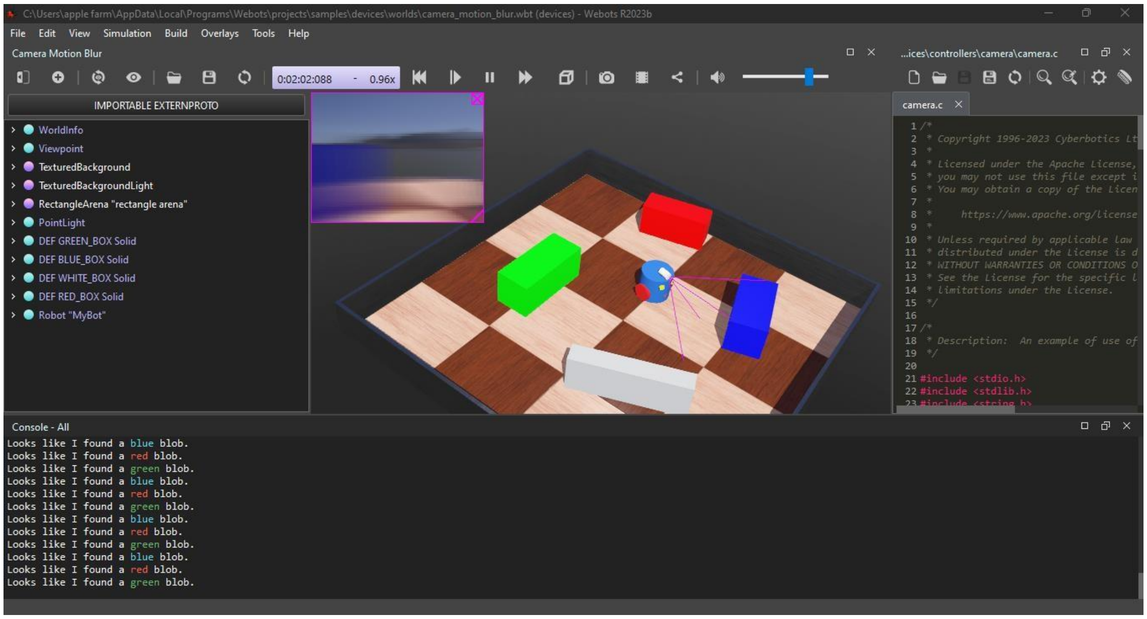
Source Code:

```
#include <webots/camera.h>

#include <webots/distance_sensor.h>

#include <webots/motor.h>

#include <webots/robot.h>


#define SPEED 1

#define TIME_STEP 32


int main() {

 WbDeviceTag camera, distance_sensor, left_motor, right_motor;


 wb_robot_init();


 /* Get the camera device, enable it */

 camera = wb_robot_get_device("camera");

 wb_camera_enable(camera, TIME_STEP);
 /* Get the camera device, enable it */
 distance_sensor = wb_robot_get_device("distance sensor");
 wb_distance_sensor_enable(distance_sensor, TIME_STEP);

 /* 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);

 /* Set the motors speed */
 wb_motor_set_velocity(left_motor, -SPEED);
 wb_motor_set_velocity(right_motor, SPEED);

 /* Main loop */
 while (wb_robot_step(TIME_STEP) != -1) {
   const double object_distance =
wb_distance_sensor_get_value(distance_sensor) / 1000;
   wb_camera_set_focal_distance(camera, object_distance);
 }
```

```
  wb_robot_cleanup();


  return 0;
}
```

Percobaan Kedua:

(5) Untuk percobaan kedua saya, saya memilih “camera_motion_blur”. Kamera ini memiliki fitur *motion blur* dan bisa *mendeteksi blob warna* (merah, hijau C biru).



```
/*
 * Copyright 1996-2023 Cyberbotics Lt
 *
 * Licensed under the Apache License,
 * you may not use this file except i
 * You may obtain a copy of the Licen
 *
 *     https://www.apache.org/license
 *
 * Unless required by applicable law
 * distributed under the License is d
 * WITHOUT WARRANTIES OR CONDITIONS O
 * See the License for the specific l
 * limitations under the License.
 */

/*
 * Description:  An example of use of
 */

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

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

Penjelasan:

-Camera_motion_blur di Webots adalah fitur yang mensimulasikan efek blur yang terjadi saat kamera bergerak cepat atau saat menangkap gambar objek yang bergerak cepat. Fitur ini sangat berguna dalam pengembangan dan pengujian algoritma pengolahan gambar dan visi komputer yang lebih realistis dalam lingkungan simulasi.

-Camera_motion_blur dalam simulator Webots juga dapat digunakan untuk mendeteksi blob warna, yaitu dengan mengidentifikasi area atau kelompok piksel yang memiliki warna serupa dan terpisah dari warna lainnya. Blob detection adalah metode pengolahan citra yang berguna untuk menangkap objek berdasarkan atribut warnanya, seperti mendeteksi blob warna merah, hijau, dan biru.

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 };

int main() {
 WbDeviceTag camera, left_motor, right_motor;
 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"};
 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();


 /* 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--;

/*
 * 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) CC (red > 3 * blue))
 current_blob = RED;
else if ((green > 3 * red) CC (green > 3 * blue))
 current_blob = GREEN;
```

```
else if ((blue > 3 * red) CC (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;
}
```