Object Tracking Robot Using OpenCV libraries

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***Abstract*— Our project main aim is to design a robot which can detect motion of an object and follow an object at the same time, which we have trained it before by Using open CV libraries. The robot will detect the color and the shape of the object which we have trained it to follow. Suppose if we trained the robot to follow a white colored ball then it doesn't follow any other object which is white or any other colored balls which has the same dimensions of the ball that we trained.**

Keywords—Robot, OpenCV libraries, object tracking, mobile camera

1. INTRODUCTION

OpenCV (Open Source Computer Vision Library) is a library of programming functions mainly for real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage and then It seez (later acquired by Intel). The library is cross-platform and is freely available under the open source BSD license. OpenCV is the most popular and used machine vision library with open source code and comprehensive documentation. Starting with image processing, 3D vision and tracking, fitting and many other features, the system contains over 2500 algorithms. The library interface supports C++, C, Python, Java (work in progress) and can run on Windows, Linux, Android, or Mac operating systems

In this project we are using Omnirobot Vision OpenCV library for Image Processing and Object Tracking. Object Tracking have a well-defined role, which is to observe people or objects as they move. In addition, the tracking software can predict the direction of movement and recognize objects or people. At first, we will be uploading an image of a desired object in the Omnirobot Vision app, after starting the robot car it will rotate 360 degree and see whether the desired object is present. If present then it will move in the direction of that object until the object is stopped and then after reaching near to object the robot also stops.

Tracking is important not only for mobile robot systems, but for many applications. Visual Surveillance, motion capture, and medical imaging all require robust real-time object tracking. Task Changes in the appearance and shading of the target object make tracking difficult conditions. In addition, an important parameter of trackers is the computational complexity. Determines if the tracker can be used in a real-time application. Tracking method used by the robot described in this paper overcomes these major challenges.

Android application have been implemented, that use image processing technology to track objects. The application was installed on an Android device connected to a 4-wheel robot with an Arduino microcontroller. The Android device is used to control the robot via the Arduino microcontroller and process the images captured via the camera. All image processing tasks are performed using an Android device without having to send the image to the server to perform the image processing task.

1.1. Video processing

The video processing library is an Android library and contains some classes for processing frames, Pass the Android camera and frame data to the frame processor. When initialized, this library will Initializes the Android OpenCV library and establishes communication with the Android device's camera. OpenCV is an open source image processing library available for Android and many other applications platform. To use the OpenCV Android library in any part of your application, the library is It was initialized correctly. Initializing the library is just "boilerplate" code, used by many frame processors. OpenCV library. For these reasons, the video processing library needs to be initialized Android OpenCV library. The video processing library will access your Android device's camera, Capture the frames one by one. The frame is then sent to the frame processor for processing.

2. Circuit diagram

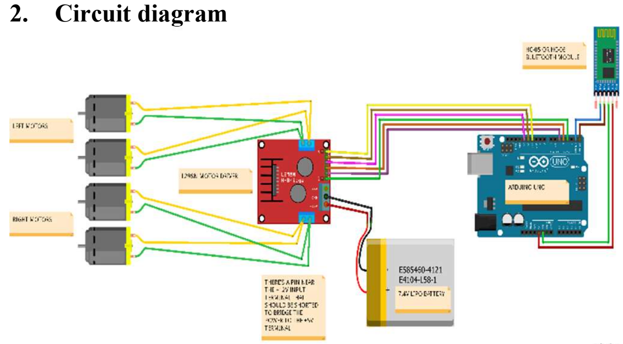
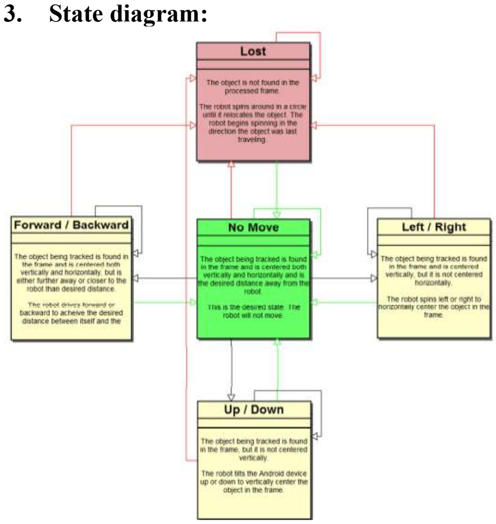


Fig1: Connections of Arduino and L298N motor driver with Bluetooth module and motors of robot car

3. State diagram:



4. Description of components

4.1. Power Supply: A power supply component is an electronic component that supplies electric energy to an electrical load. The primary function of a power supply is to convert electrical energy to another form and due to this, power supplies are sometimes referred to as electric power converters.

4.2. Bluetooth module: It is wireless serial communication module which can be connected with a Micro-Controller to receive and send data when connected with other Bluetooth devices.

4.3. Arduino-UNO: Arduino is an open source prototyping platform based on hardware and software. Arduino consists of a programmable physical circuit board and software (IDE) that runs on a computer and is used to write computer code and upload it to a physical board. 14 digital input/output pins (6 available as PWM outputs), 6 with analog input, 16 MHz crystal, USB connection, power jack, ICSP header, reset button

4.4. Motor driver: It is a small circuit that drives the motor driving IC, and can control two motors at the same time. It controls the motor speed by pulse width modulation (PMW). Once the device is all set up the Android Device require an application called ―CAR BLUETOOTH RC which sends the control command to the Bluetooth Module connected with the Arduino. The Arduino receives these commands and transfers them to the Motor Driver from the digital input-output pins of the Arduino. The motor driver has two DC motor connected to the output terminals and it runs the two motor according to the control commands sent by the Arduino. The motor driver can run a single motor or both the motor at the same time in same or different direction which gives the user an advantage to run the motor in any direction.

The motor driver is double H-bridge drive chip-L298N, voltage range is 5V~35V, current range is 0~36mA. When the driving voltage is 7v-35v, the maximum power consumption is 25W, built-in 5v power supply.

4.5. Omnirobot Vision OpenCV library: This is used For Image Processing and Object Tracking. Object Tracking have a well-defined role, which is to observe people or objects as they move. In addition, the tracking software can predict the direction of movement and recognize objects or people.

5. Procedure:

1. download and open the Omnirobot Vision open cv library, On Page 1, click on BALL button. Then click on / symbol next to the BALL button.

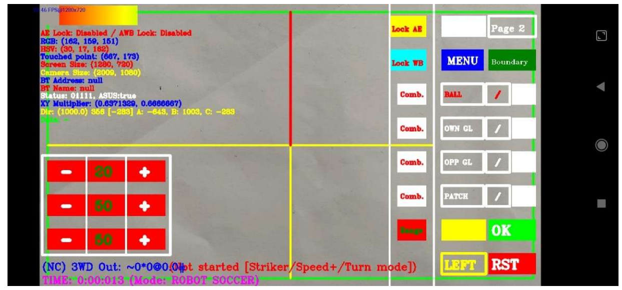


Fig3: picturization of point 1

2. Point the camera to the object color you want to detect, then tap on that object's image. The app will highlight the object detected.

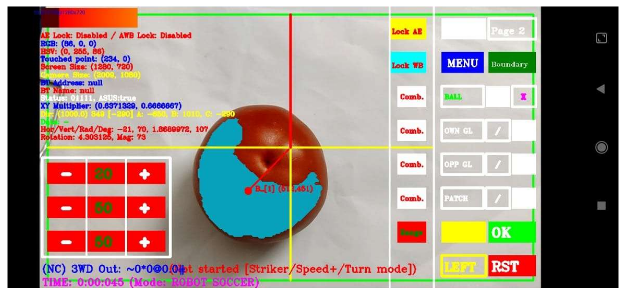


Fig4: picturization of point 2

3. If you are satisfied with the detection coverage, click OK button. If not, adjust the detection quality by playing around three values in the red boxes located at the bottom left of the screen (the red boxes only appear after you click BALL button, and will be hidden when you click OK button). The green numbers inside the red boxes denote the values for HSV's range. You can also adjust the HSV values themselves by pressing the Range button (located next to the yellow box beside the OK button), and when it turns to yellow, the HSV values will be shown. Normally, we don't really need to adjust the Range and HSV values as the app will automatically set the best values every time we tap on the object's color we want to detect.

4. Press Lock AE (lock auto exposure) and Lock WB (lock white balance) to make sure those parameters are reserved even when the surrounding lighting changes.

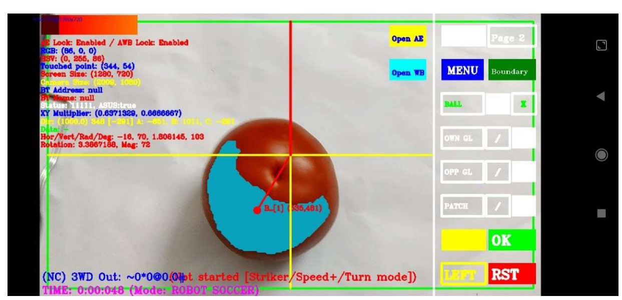


Fig5: picturization of point 4 after pressing lock AE and WB

5. The label Comb. on the Comb. button will make the app combine all the same colors into one COG (center of gravity). If you want the app detect the largest blob, press on it until it

displays Larg. Else if you want the app to detect your desired color separately, click on it again until it displays Sapa.

6. If everything is OK, press OK. If you want to edit the detection parameters again, just press on the BALL button again.

7. Go to Page 2, increase Rot. speed (rotational speed) and Pref. speed (preferred speed) as you wish and click START button to make your robot move. Press STOP button to make it stop.

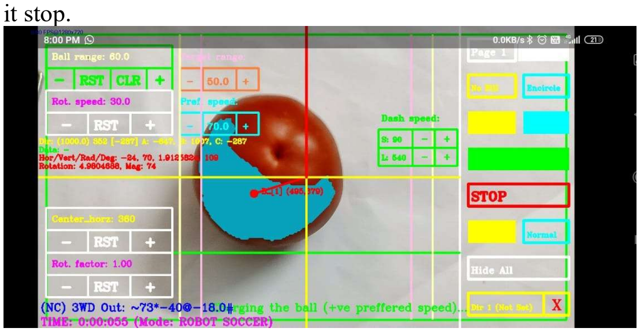


Fig6: picturization of point 7

6. Advantages

- Portable, easy to use and easy to implement
- Open source can flexibly respond to new changes and implementations
- Most traditional robots for tracking and detection are expensive, have large hardware, In our case, the robot is built using commonly available generic electronic components

7. Applications

- Covering Harsh Terrains for Research Work
- Home Security and surveillance
- Development and research of open computer vision for portable platforms
- Can be used to teach robotics and open source applications development for institutional education purpose

8. Result

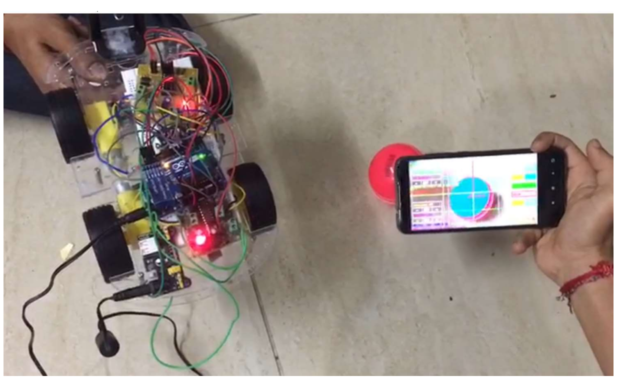


Fig7: snapshot of the final output when the phone camera is facing the ball

Inference:

From fig7, when the phone camera is facing the desired ball then the app will calculate and send the distance and angle to the bluetooth, then from bluetooth the information passes to the arduino. Then arduino sends commands to the motor driver to move the robot car in the desired direction

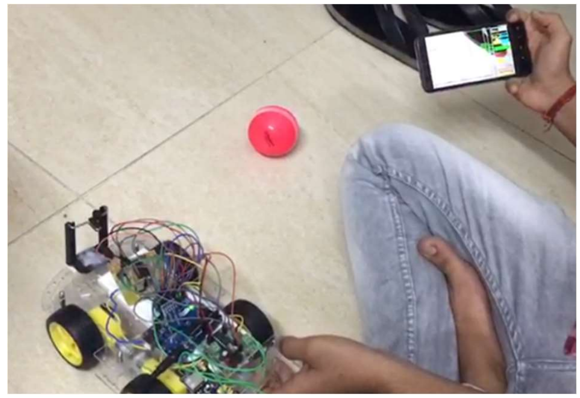


Fig8: snapshot of the final output when the phone camera is not facing the ball

Inference:

From fig8, when the phone camera is not facing the desired ball then the robot will rotate through circle to search for the ball if found then it repeates the fig6 inference if not then the robot car stops

9. Conclusion:

This project describes about the robot car built with Arduino controlled by an Android device for tracking and following moving objects and also explains how to use OpenCV libraries in the applications like image processing and object tracking. Android device is also used to process the acquired images through the camera. If the phone camera is not facing the desired ball then the robot will rotate through a circle to search for the ball if found then the app will calculate and send the distance and angle to the Bluetooth, then from Bluetooth the information passes to the Arduino. Then Arduino sends commands to the motor driver to move the robot car in the desired direction if not then the robot car stops

10. Reference:

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