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3D Ball tracking using OpenCV

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ABSTRACT: Humans perceive the world using many senses (sight, hearing, smell, touch, etc.). The majority of machines can only accept input through wired and wireless communication channels, or with straightforward input devices like keyboards and mouse.Computer vision is a method of automating the understanding of images and videos on a machine. OpenCV is the platform of choice for many Vision developers, co-developed by the Vision community and available for free. In this project, you can trace the ball in 3D. Use Python to find and retrieve the coordinates of the ball and send those values to Unity's 3D environment. This is done in real time for best results.A library called Open CV is employed in computer vision programmes. Numerous apps that perform better in real time can be made with the aid of OpenCV. primarily utilised for altering images and videos.Tracking a ball in 3D using two cameras, and analyzing the result. Uses OpenCV and computer vision techniques to identify points, strokes, bounces, etc.
This project is not optimized for long-term use, but it does provide ideas on how to easily apply OpenCV and computer vision to ball games. It has only been tested on videos recorded at 720p and 30 fps on two iPhones and may need to be modified to work well in other configurations.
This project was created to trace a ball in one color using OpenCV. The color of the ball can be adjusted according to your needs. The code provides three values that are proportional to the 3D coordinates of the space based on the camera.

I. INTRODUCTION

This document will show you how to use OpenCV to detect and track bullets. Object and person recognition and tracking are increasingly popular topics these days. The solution described does it. It can detect the ball in the range set by the user and collect information about all positions in 3D. You can save it to your computer and use it, for example, to view the trajectory of the ball.

OpenCV is the platform of choice for many Vision developers, co-developed by the Vision community and available for free. In this project, you can trace the ball in 3D. In this project you can create a game. Computer vision is a method of automating the understanding of images and videos on a machine. Use your senses (sight, hearing, smell, touch, etc.) to perceive the world and connect in real time. This project's goal is to use OpenCV software to track the motion of a ball. The camera recognises and follows the motion of objects via motion tracking. The study of relevant earlier works will be used in this project as a guide for the motion tracking techniques.

Literature reviews discuss related earlier work, and a research based on the project's scope was employed as the technique. Only color-based optical flow and feature extraction image processing techniques are included in this project's scope. Edge detection under optical flow technology, which employs technology based on color-based segmentation, was chosen as the approach for this ball motion tracking application. The methodologies used are based on the results of the research, are effective, and are used for the majority of the job.

Many real-world applications, including video surveillance, video games, and cultural and medical examples like motion and behavioural studies, all require motion tracking. Based on several visual properties such colour regions, edges, contours, and textures, simple objects can be identified and tracked. On the other hand, complex objects like the human face need more sophisticated skills to manage several potential instances of the object class. An excellent substitute are statistical techniques. Statistical models uncover a variety of patterns associated with the subject of study, including: B. Motion tracking of various human facial perspectives, both good and bad examples.

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II. LITERATURE REVIEW

This section introduces current innovations and accepted practices previously incorporated into various journals and articles related to 3D ball tracking using OpenCV and computer vision. The purpose is also to briefly introduce the advances in technology used.

The following paper was written by Tianweiyin. The title of the work is "Center-based 3D Object Detection and Tracking". This paper was disseminated in a 2021 ResearchGate article. Please indicate the economic impact on fuel demand. [1]

The following article was written by Tobias Fischer, minsun and others. The title of the article is "Monocular Semi-Dense 3D Object Tracking". JournalofJanuary12-05, 2021. [2]

The following articles are Garg P, Aggarwal N, Sofat, S, "Vision Based Hand Gesture Recognition", World Academy of Science, Engineering and Technology, Vol. 49, pp. 972-977, 2009 [3]

The following paper was written by Yubo cui, Zheng Fang and Jia yaoshan. The title of the article is "3D Object Tracking with Transformer". This paper was published on October 28, 2021 [4].

The following article was written by Antonio Prioletti, Jeannette Bohg and others. The title of the article is Probabilistic 3D Multi-Object Tracking for Autonomous Driving (January 16, 2020) [5].

III. IMPLEMENTATION

The steps and processes of project implementation are described here:

OpenCV Module

A collection of Python bindings called OpenCV-Python is used to solve computer vision issues. Gary Bradsky founded OpenCV in 1999, and the initial version was made available in 2000. With Gray Bradsky, Vadim Pisarevsky oversaw Rassian Software's OpenCV team.A growing number of computer vision and machine learning-related techniques are presently supported by OpenCV, which is growing every day. The 2005 DARPA Grand Challenge winning vehicle Stanley made use of OpenCV.The largest open-source library for image processing, machine learning, and computer vision, known as OpenCV, is currently essential to the most crucial real-time processes in modern systems.

Computer vision

Understanding images and videos, how they are stored, and how to change and extract data from them is the process of computer vision. Artificial intelligence is mostly based on computer vision. In autonomous vehicles, robotics, and photo-editing apps, computer vision is crucial.

Unity

The 3D/2D gaming engine Unity doubles as a potent cross-platform IDE for programmers. Many of the most crucial in-built features required to make the game function can be provided by Unity. This includes collision avoidance, 3D rendering, and physics. Authors may drag and drop components into the scene to change their properties thanks to the visual editor in the Unity software.

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Importing modules

```
import cvzone
from cvzone.ColorModule import ColorFinder
import cv2
import socket

```

ColorFinder:

```
success, img = cap.read()
h,w,_ = img.shape

myColorFinder = ColorFinder(False)
hsvVals = {'hmin': 0, 'smin': 102, 'vmin': 153, 'hmax': 74, 'smax': 255, 'vmax': 255}

sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
```

BallMovement:

```
usingSystem.Collections;
usingSystem.Collections.Generic;
usingUnityEngine;

publicclassBallmovement : MonoBehaviour
{
   // Start is called before the first frame update
   publicUDPReceiveudpReceive;
   voidStart()
   {

   }

   // Update is called once per frame
   voidUpdate()
   {
      stringdata = udpReceive.data;
      data = data.Remove(0,1);
      data = data.Remove(data.Length-1, 1);

      string[] info = data.Split(',');

      floatx = float.Parse(info[0])/100;
      floaty = float.Parse(info[1])/100;
      floatz = float.Parse(info[2])/1000;

      gameObject.transform.localPosition = newVector3(x,y,z);
```

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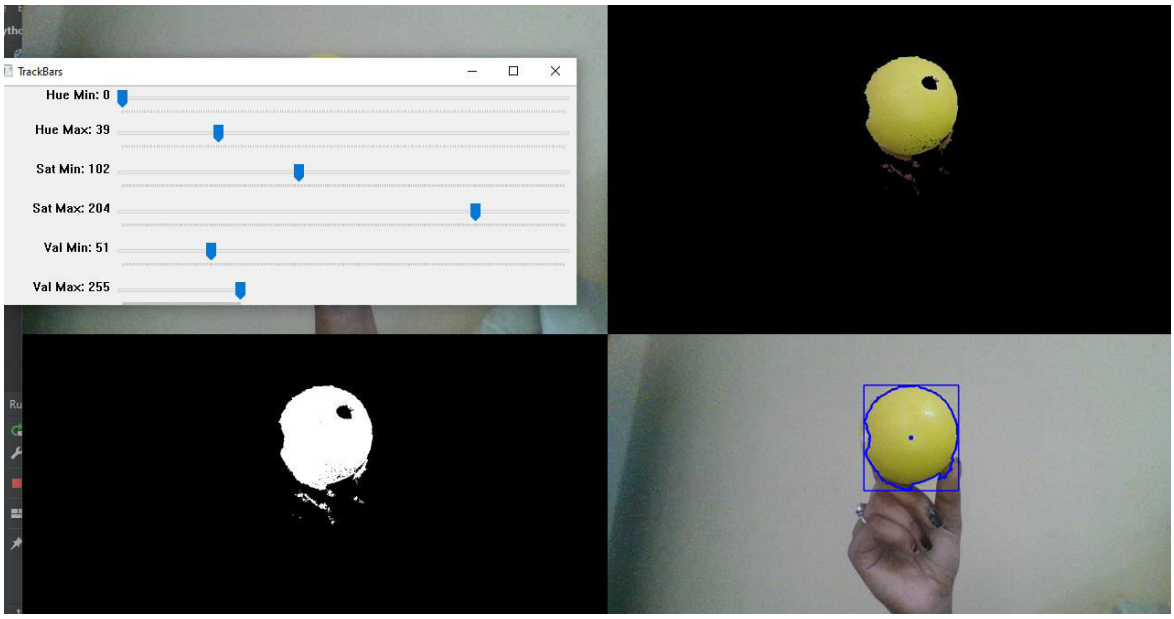
IV. ANALYSIS




```
12
13  myColorFinder = ColorFinder(True)
14  hsvVals = {'hmin': 0, 'smin': 102, 'vmin': 153, 'hmax': 74, 'smax': 255, 'vmax': 255}
15
16  sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
17  serverAddressPort = ("192.168.1.111", 5053)
18
```

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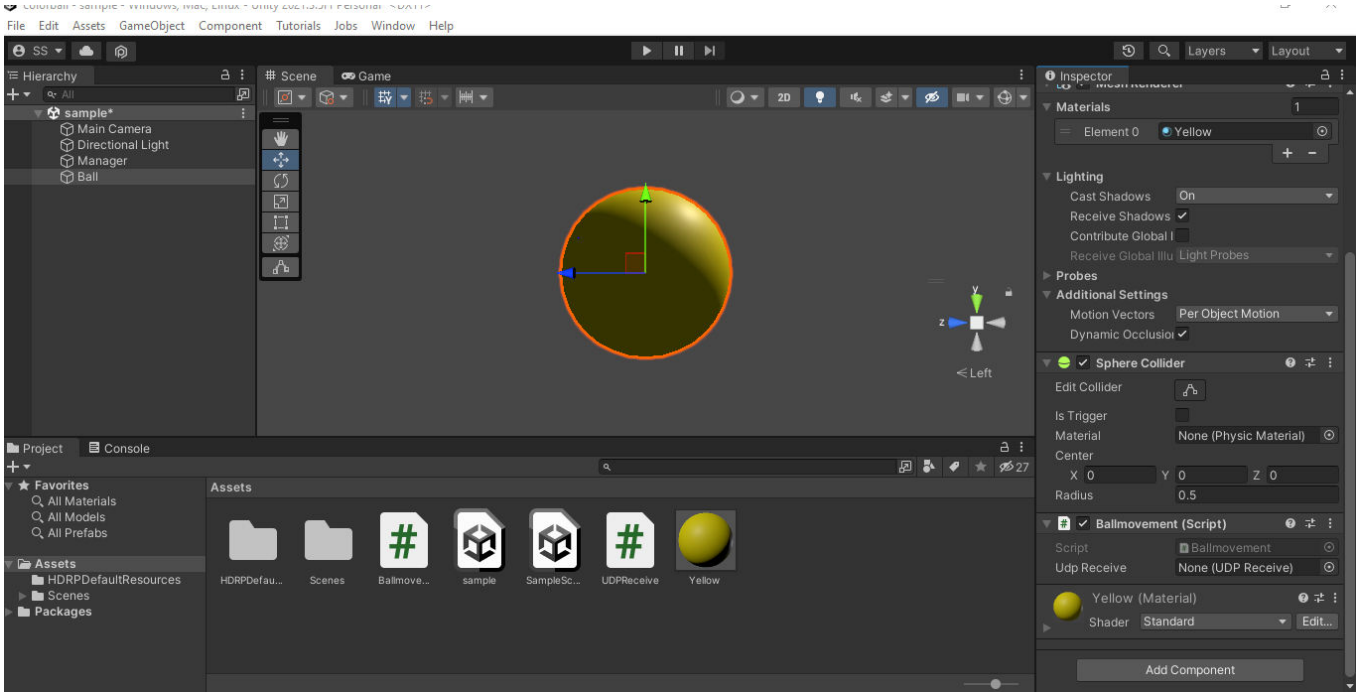

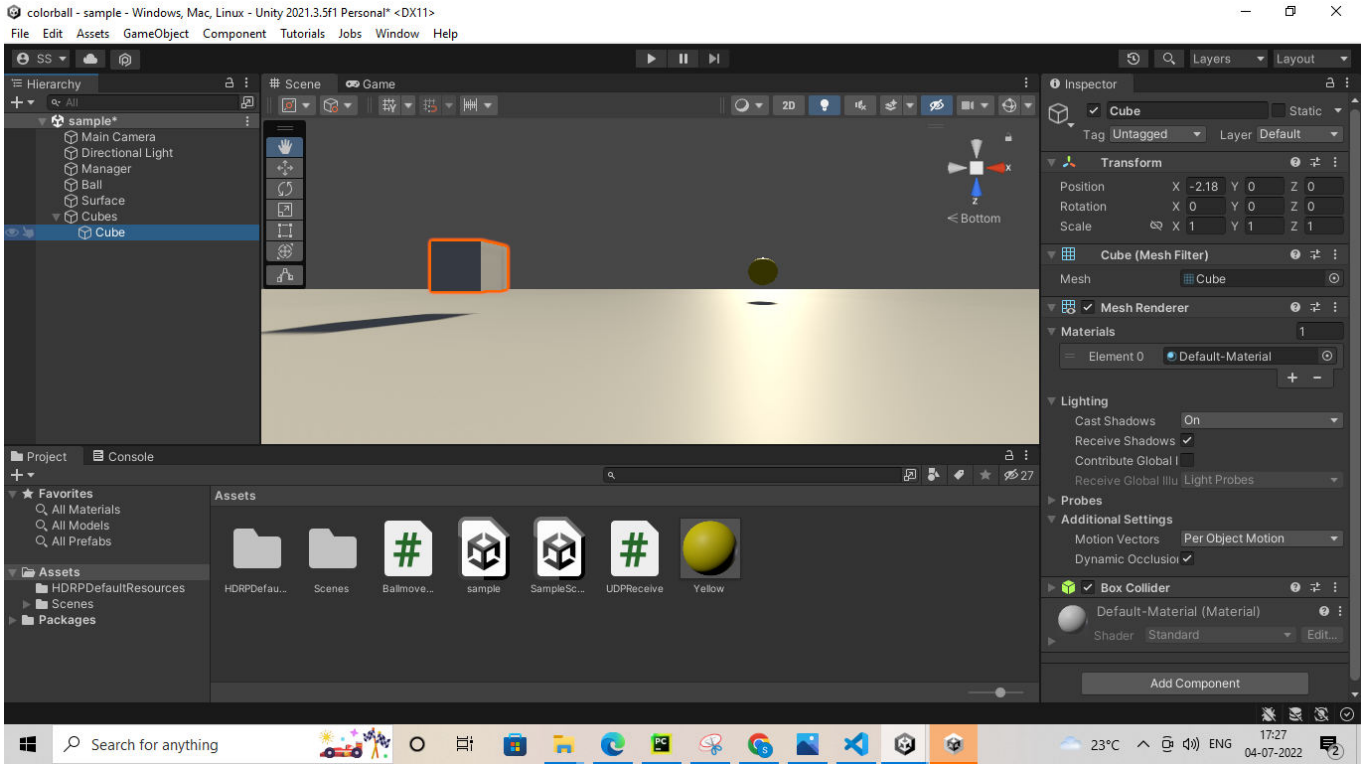

V. CONCLUSION

This project was created to trace a ball in color using OpenCV. The color of the ball can be adjusted according to your needs. The code provides three values that are proportional to the 3D coordinates of the space based on the camera. Track the ball in 3D with two cameras and analyze the results. Use OpenCV and computer vision technology to

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identify dots, dashes, bounces, and more. Simple objects can be recognised and tracked based on a variety of visual characteristics, including color areas, edges, contours, and textures. Sight, sound, smell, and touch are just a few of the senses you can use to connect in the present and comprehend the environment. The objective of this project is to track a ball's motion using OpenCV software. Motion tracking allows the camera to identify and track moving objects.

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[4] Min Sun, Tobias Fischer, and other people. The study is titled "Monocular quasi-dense 3D object tracking." Journal entry for January 12-05, 2021
[5]"Accurate 3D action identification utilising learning on the Grassmann manifold," PatternRecognition, 48, 556-567, by Rim Slama, Hazem Wannous, Mohamed Daoudi, and Anuj Srivastava (2015).
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[10] Jiayao Shan, Zheng Fang, and Yubo Cui. "3D Object Tracking using Transformer" is how the paper is titled. This article was released on October 28, 2021.

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