



IEEE BPIT

PROJECT REPORT

SYMPHONY

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INTRODUCTION

Symphony is an interactive music experience that utilizes computer vision technology to detect leg gestures made by the participant using ArucoMarkers. The project utilizes the OpenCV library and ArucoMarkers to detect specific markers placed on the floor, and through the use of boolean expressions in conditional statements, produces corresponding musical notes or sounds. This project also incorporates the Tkinter library to provide a user-friendly interface for the participant, making the experience more engaging and interactive. Written in Python, Symphony utilizes various other libraries such as NumPy, threading, time, OS, Tkinter and PyGame to facilitate image processing, threading, and sound output for a seamless and exciting experience.

OBJECTIVES

- To detect markers placed on the floor using OpenCV.
- To produce sounds when markers are detected using boolean expressions in conditional statements.
- To provide a better user interface for the participant using Tkinter.
- To make the game more responsive by using threading and the time module.

METHODOLOGY AND RESEARCH

- Symphony employs advanced computer vision technology, specifically the OpenCV library, to detect markers placed on the floor.
- The markers are accurately identified through the use of the ArucoMarkers module within the OpenCV library.
- To enhance performance and responsiveness, the project incorporates the threading module.
- Audio files are played in response to marker detection with the use of the Pygame library.
- The NumPy library is utilized to handle arrays and matrices within the code for efficient data manipulation.
- A user-friendly interface for the participant is provided through the use of the Tkinter library.
- The code employs the random module to randomly shuffle the audio files played, adding an element of unpredictability to the experience.
- The function "find_aruco" is used to detect markers by taking an image as input and utilizing the Aruco module within OpenCV, providing accurate and real-time detection.
- The function "func" is called by the "find_aruco" function, which checks for marker detection and plays corresponding audio files using the mixer module, providing a dynamic and interactive experience.
- The code also includes a function "counter()" which is used to increment a count variable, to track the number of marker detections, and provide feedback to the user.

FUTURE SCOPE

- Symphony can be expanded to include a greater variety of markers and more intricate gesture recognition, providing even more opportunities for the participant to control and interact with the music.
- Integrating Symphony with other music production software can open up a wide range of creative possibilities, allowing for even more dynamic and unique musical performances.
- The project's unique and interactive nature makes it an ideal fit for various performance settings, such as dance shows, concerts, and other live events.
- The technology behind Symphony can also be applied in other fields, such as gaming, fitness, and rehabilitation, providing new opportunities for interactive and engaging experiences.
- Symphony could be enhanced with the integration of additional sensors and hardware to increase the precision and accuracy of marker detection and gesture recognition.
- Machine learning techniques could be implemented to improve the adaptability and versatility of the system.
- The project could be adapted for use in virtual and augmented reality environments, providing even more immersive and interactive experiences.
- Symphony could be utilized in educational settings as a tool for teaching music and programming.
- Symphony can be integrated with other digital music instruments and used in various fields such as music production, therapy, gaming, advertising, and entertainment.
- It can also be adapted for use in virtual and educational settings, providing immersive and interactive experiences.

PROJECT SOURCE CODE AND RESULTS

Code for Marker Detection

```
import threading
import time
import cv2
import cv2.aruco as aruco
import numpy as np
from pygame import mixer
import imutils
import random
check = False
class ntm():
    def __init__(self, img):
        threading.Thread.__init__(self)
        self.find_aruco = threading.Thread(target=find_aruco,
args=(img))
        self.find_aruco.daemon = True
    def run(self, img):
        print("????????")
        find_aruco(self, img)
id = []
# dict = {103: '1_part.mp3', 1: '2_part.mp3', 2: '3_part.mp3', 3:
'4_part.mp3', 4: '1.mp3', 5: '2.mp3', 6: '3.mp3', 8: '4.mp3'}
dict = {4: '1_part.mp3', 5: '2_part.mp3', 6: '3_part.mp3', 8:
'4_part.mp3'}
mixer.init()
```

```

def find_aruco(img, markersize=6, totalmarkers=250, draw=True):
    # gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
    # gray2 = cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)
    thresh1 = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
    # cv2.threshold(gray, 175, 255, cv2.THRESH_BINARY)[1]
    #     thresh2 = cv2.threshold(gray2, 100, 255, cv2.THRESH_BINARY +
cv2.THRESH_OTSU)[1]
    #     imggray=cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
    key = getattr(aruco,
f'DICT_{markersize}X{markersize}_{totalmarkers}')
    arucodict = aruco.Dictionary_get(key)
    arucoparam = aruco.DetectorParameters_create()
    # bboxes, ids, rejected = aruco.detectMarkers(thresh1, arucodict,
parameters=arucoparam)
    bboxes, ids, rejected = aruco.detectMarkers(thresh1, arucodict,
parameters=arucoparam)
    #     bboxes1, ids1, rejected1 = aruco.detectMarkers(thresh2,
arucodict, parameters=arucoparam)
    # chnone(ids, ids1)
    id = np.unique(ids)
    # + np.unique(ids1)
    print(id)
    func(id, check)
    # id.append(ids)
    if draw:
        aruco.drawDetectedMarkers(thresh1, bboxes)
        cv2.imshow("threaded image", thresh1)
count = 0
def one():

```

```

    mixer.music.play()
def check_all(id):
    a = id.size
    if a == 4:
        return True
def counter():
    global count
    if count < 50:
        count += 12.5
    print(count)
def chnone(id):
    id1 = [4, 5, 6, 8]
    id = id1
    id0 = np.random.shuffle(id1)
    i = id[0]
    k = random.randint(4, 8)
    if k != 7:
        if id1[0] != 4 or id1[0] != 5 or id1[0] != 6 or id1[0] != 8:
            mixer.music.load(dict[k])
            mixer.music.play()
            time.sleep(4)
            counter()
# def chnone(ids, ids1):
#     mixer.music.load('1.wav')
#     if ids is None or ids1 is None:
#         ids = 0 if ids is None else ids
#         ids1 = 0 if ids1 is None else ids1

```

```

#         elif ids[0] != [0] or ids1[0] != [0]:
#             mixer.music.play()
#             counter()
#             time.sleep(10)
#             b = False
#             mixer.music.load('2_part.mp3')
#             return
#         elif ids[1] != [1] or ids1[1] != [1]:
#             one()
#             counter()
#             b = False
#             mixer.music.load('3_part.mp3')
#             return
#         elif ids[2] != [2] or ids1[2] != [2]:
#             one()
#             counter()
#             b = False
#             mixer.music.load('4_part.mp3')
#             return
#         elif ids[3] != [3] or ids1[3] != [3]:
#             one()
#             counter()
#             b = False
#             # mixer.music.load('music/5_part.mp3')
#             return
#     elif ids[4] != [4] or ids1[4] != [4]:
#         one()

```



```

#     counter()
#     b = False
#     mixer.music.load('music/6_part.mp3')
#     return
# elif ids[5] != [5] or ids1[5] != [5]:
#     one()
#     time.sleep(10)
#     counter()
#     b = False
#     mixer.music.load('music/7_part.mp3')
#     return
# elif ids[6] != [6] or ids1[6] != [6]:
#     one()
#     time.sleep(10)
#     counter()
#     b = False
#     mixer.music.load('music/8_part.mp3')
#     return
# elif ids[7] != [7] or ids1[7] != [7]:
#     one()
#     time.sleep(10)
#     counter()
#     b = False
#     return
def func(id, check):
    if id.size != 4:
        print("True")

```

```

        mixer.init()

        check = True

        chnone(id)

        # if check:
        #
        #     print("Running")
        # else:
        #     print(" ??? ")

        return check

def main():

    cap = cv2.VideoCapture(1)

    while True:

        success, img = cap.read()

        find_aruco(img)

        cv2.waitKey(1)

if __name__ == "__main__":

    main()

```

Code for GUI

```

from tkinter import *
from random import *

class MusicPlayer:

    def __init__(self, root):

        self.root = root

        self.root.title("Symphony")

        self.root.geometry("1000x700+100+0")

```

```

self.track = StringVar()

self.status = StringVar()

self.shapeframe =
LabelFrame(self.root, text="Shapes", font=("times new
roman", 15, "bold"), bg="grey", fg="white", bd=5, relief=GROOVE)

self.shapeframe.place(x=0, y=0, width=1000, height=500)

#matrix Labels

self.a00 = LabelFrame(self.shapeframe, bd=5)
self.a00.place(x=0, y=0, width=333, height=150)

self.a01 = LabelFrame(self.shapeframe, bd=5)
self.a01.place(x=333, y=0, width=333, height=150)

self.a02 = LabelFrame(self.shapeframe, bd=5)
self.a02.place(x=666, y=0, width=333, height=150)

self.a10 = LabelFrame(self.shapeframe, bd=5)
self.a10.place(x=0, y=150, width=333, height=150)

self.a11 = LabelFrame(self.shapeframe, bd=5)
self.a11.place(x=333, y=150, width=333, height=150)

self.a12 = LabelFrame(self.shapeframe, bd=5)
self.a12.place(x=666, y=150, width=333, height=150)

self.a20 = LabelFrame(self.shapeframe, bd=5)
self.a20.place(x=0, y=300, width=333, height=150)

self.a21 = LabelFrame(self.shapeframe, bd=5)
self.a21.place(x=333, y=300, width=333, height=150)

self.a22 = LabelFrame(self.shapeframe, bd=5)
self.a22.place(x=666, y=300, width=333, height=150)

```

```

#ButtonFrame

    buttonframe = LabelFrame(self.root, text="Control
Panel", font=("times new
roman", 15, "bold"), bg="#AFB4FF", fg="white", bd=5, relief=GROOVE)

    buttonframe.place(x=0, y=500, width=1000, height=330)

    plybtn = Button(buttonframe, text="PLAY", command=self.playsong,
width=30, height=1, font=("times new roman", 16, "bold"),
fg="#100720", bg="#B1E1FF").grid(row=0, column=0, padx=300, pady=50)

    #song frame

    #scrolling and lust

    def change(self, color, ls, i=0):

        if(i<8):

            ls[i].config(bg=color)

            ls[i].after(1500, self.change, 'white', ls, i)

            ls[i].after(1500, self.change, 'aqua', ls, i+1)

    #shape = Shape(shapeframe)

    def playsong(self):

        ls = [self.a00, self.a01, self.a02, self.a10, self.a11,
self.a12, self.a20, self.a21, self.a22]

        shuffle(ls)

        self.change('aqua', ls)

root = Tk()

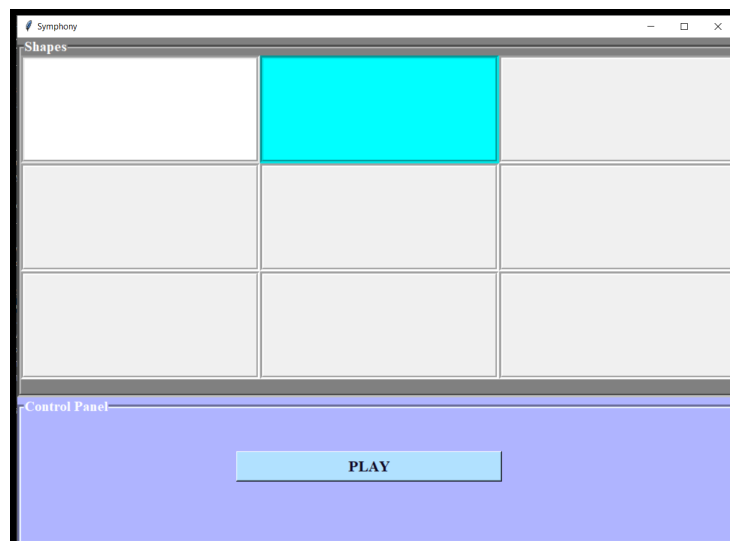
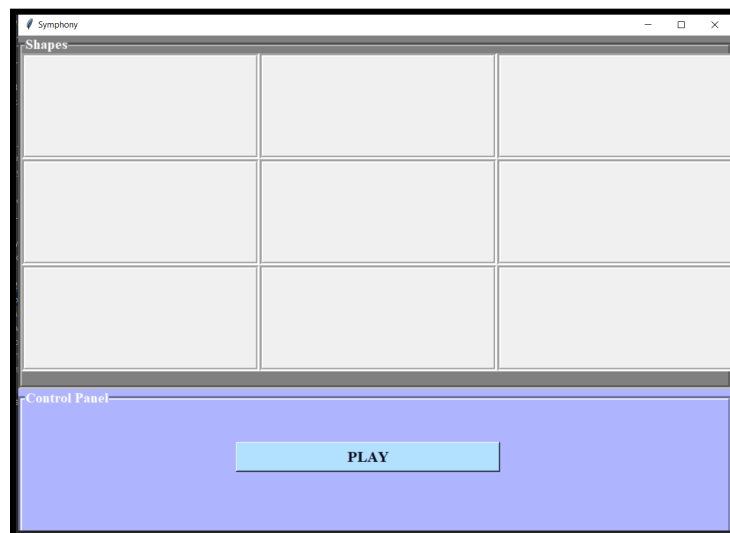
MusicPlayer(root)

root.mainloop()

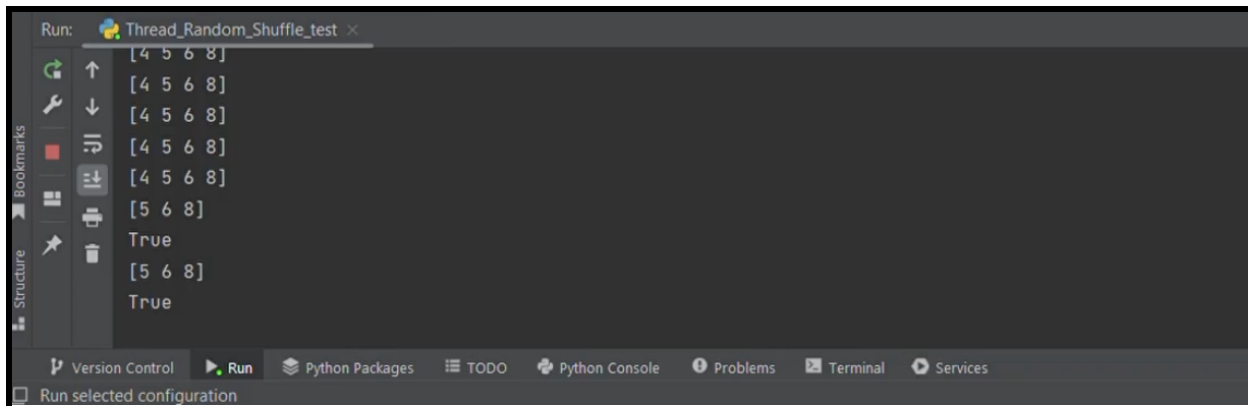
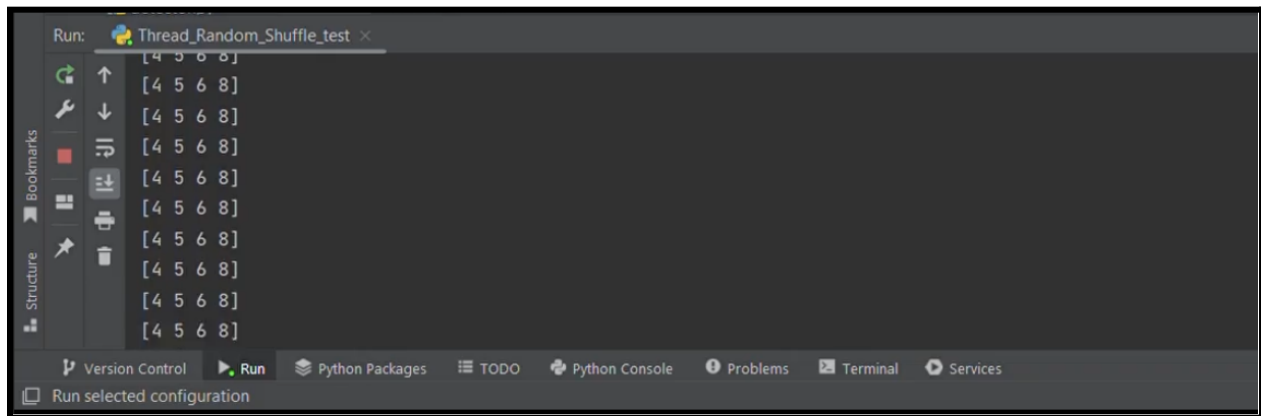
```

SNAPSHOTS OF CODE

Symphony UI



Output Window Showing The IDs Of Detected ArucoMarkers



IDs of ArucoMarkers being triggered for detection and playing sounds



CONTRIBUTORS

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1	Vineet Thakur	4th Year EEE
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