International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 12 | Dec - 2021 ISSN: 2582-3930

Efficient Physiotherapy Exercises using Machine Learning

Darshil Savaliya[1], Vedant Sawant[2], Prajakta Pradhan[3] , Prof. Sandhya Awate[4]

[1234]*Department of Computer Engineering, A. C. Patil college of Engineering, Kharghar*

Abstract - Physiotherapy plays a crucial role to prevent disease and disability but in today's era people are so fascinated by computer games that they completely neglect their health. Due to the traditional methods of playing games using mouse and keyboard most of the people are becoming victims of obesity due to almost no movement. To overcome this problem we have designed an OpenCV project which will help the user to play games using their hand, body gestures and voice commands. Such as movements usings OpenCV which includes Z-Axis or depth and speech recognition using google cloud API. With the help of this method we are trying to replace the conventional methods of playing games, by bringing this gesture based system to increase the movement of the users and helping them to stay active without even hustle.

Key Words: OpenCV, Hand Gesture, Voice Command, Machine Learning, Speech Recognition

1.INTRODUCTION

Playing games using OpenCV, also known as gesture controlled gaming system, is one that allows users to interact with the system (game) through body gestures. Input is usually in the form of hand gestures, voice command and retina. Retina is responsible for the cursor movement in the game whereas voice commands will make it easier for the user to achieve some functionality like sprint and walk. We aim to provide an effective gesture recognition module in order to control the ingame movements and to indulge the gaming population to a more physically oriented way of playing games.

2. SYSTEM ARCHITECTURE

The user requires a PC installed with a webcam or a laptop which has inbuilt webcam to capture the movements. Apart from this, the user must have a game installed on its device which supports mouse and keyboard functionalities.

Once everything is set up, the application will run in the background and within the area of contact region the user must move their hands to get the desired action to take place in the game.

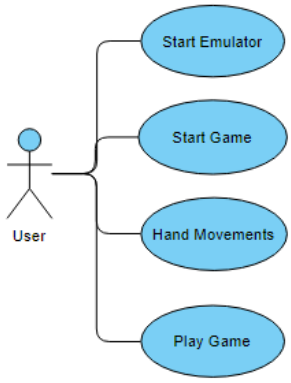

Fig -1. Use case diagram

Once everything is set up, the application will run in the background and within the area of contact region the user must move their hands to get the desired action to take place in the game. MSS library is responsible for taking the screenshots of the screen. These screenshots will be analyzed by OpenCV and the image will be filtered out to see the hand movements only. Along with this google API will be responsible to detect the speech commands. By using an eyeball tracking mechanism, we can detect the cursor position. For each frame, the program will detect the face and the eyes, then it will go for the position of the pupils for higher accuracy, to analyze gaze in real-time.

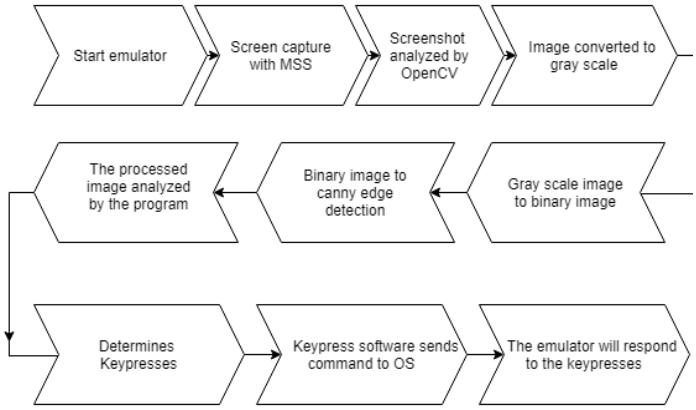

Fig -2. Data Flow Diagram

1. Emulator will start in the background at any one corner of the screen.
2. With the help of the MSS library, we will take a screenshot of the screen.
3. These screenshots will be analyzed by the OpenCV.
4. Then following steps will take place in image conversion
    a. Image will be converted to gray scale image
    b. Gray scale image will be converted to binary image.
    c. Canny edge detection will be applied on it.
    d. On that image gaussian blur will be applied to remove the noise.
    e. The processed image will be analyzed by the program
    f. The program will analyze the desired key hand gesture action
    g. Followed by it, desired action will take place in the game.

3. TECHNOLOGIES USED

Python

Python is an high level computer programming language often used to build programs, automate tasks, and conduct data analysis

Libraries Used

OpenCV

OpenCV is a great tool for image processing which helps us to perform computer vision tasks in real-time. It can be used to perform tasks like hand gestures, face recognition.

MSS

MSS is an ultra-fast cross-platform multiple screenshots module in python.

NumPy

NumPy is a Python library which is used for working with arrays. It also supports large multidimensional arrays and matrices. Mathematical and logical operations can be applied with the help of NumPy.

API Used

Google Speech

It converts all the verbal actions into code and perform the desired actions**.**

For example : “Use nitrous” command will trigger keyshift and use nitrous in the game

4. HARDWARE AND SOFTWARE REQUIRED

Sr. No	Parameters	Requirements
1.	Libraries Imported	OpenCV, MSS, NumPy
2.	Language	Python 3.5...3.8
3.	GPU and RAM	4GB GTX 1050Ti, 8 GB DDR4
4.	OS	Windows
5.	Storage	2GB or more

Table -1: Hardware and software required

5. BENEFITS FROM SYSTEM

Users will play games using gestures and DIY papers. Once the user holds these items, he will be able to interact with the games. All the movements will be related to hands and thumbs as these are the most important exercises.

Movements

1. Move forward - By Default
2. Move right - Turn hands/paper right side
3. Move Left - Turn hands/paper left side
4. Move Backward - Use right thumb
5. Nitrous - Use Left Thumb

6. Handbrake - Use both thumbs
7. Eye Movements - Move cursor
8. Blink - Click

Based on these, we track all movements of the user and give a final report in the end. As the race lengths increase, the number of movements increase making sure the user performs all required exercises.

Fig -3: User playing game - Making hand movements

Fig -4: Tilting hand to turn

Duration (Game Length)	Both Thumbs simultaneously	Right Thumb Movements	Left Thumb Movements	Hand (Left and Right) Movement
2 Mins	5	2	34	81
3 Mins	8	0	42	141
6 Mins	12	12	67	384

Table -2: Hand movements

6. RESULTS

We took multiple surveys to check if the patients were willing to perform exercise to maintain a healthy lifestyle. Earlier 75% of the people disagreed to use the OpenCV for the exercise but after showing them the demo 80% of those people were willing to use games for exercises. Average time they were ready to spend was 2hrs a day.

7. CONCLUSIONS

Implemented a way to let people keep playing games but to indulge them into a way of physically handling those games rather than just tapping screens, this is where gesture controlled gaming also known as gesture controlled gaming gets introduced.

8. FUTURE SCOPE

Using OpenCV posenet we can make a whole body scan and perform various activities or exercises, such as cardio, leg movements etc. This will ensure that full body movements are made and patients are willing to use technology to make exercises interesting.

REFERENCES

1. Ruchi Manish Gurav & Premanand Kadbe, “Real time finger tracking and contour detection for gesture recognition using OpenCV”, www.researchgate.net/publication/282956557Real_time_finger_tracking_and_contour_detection_for_gesture_recognition_using_OpenCV
2. Amiraj Dhawan and Vipul Honrao implementation of hand detection based techniques for human-computer interaction, International Journal of Computer Applications (0975 – 8887).
3. Mr. Sagar P.More, Prof. Abdul Sattar - Hand Gesture Recognition System Using Image Processing, in International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) - 2016
4. Prateek Joshi, “OpenCV with Python By Example”
5. OpenCV usage documentation http://docs.opencv.org