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Hand Gestures for Laptop 2.0

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Abstract: The communication between the user and the computer can be done through various input devices such as the keyboard, mouse etc. This paper shows a more intuitive and natural form of communication that is via hand gestures. The gestures performed by the user are recognized by the system and the action specified to the program is performed, henceforth eliminating the use of any of the hardware input devices completely. This method involves the usage of image processing to recognize the gestures and has built in functions for every gesture provided by the PyAutoGUI module. This method uses the Python Coding and uses the OpenCV library provided by Python. The experiments clearly prove that the implementation is very reliable for practical use.

Keywords: Gestures, OpenCV library, PyAutoGUI, Python

I. INTRODUCTION

As the world is constantly changing and progressing, technology has progressed exponentially in mere two decades thanks to the invention of smart phones due to which accessing the internet is very simple and has made the world even a smaller place. The human-computer interaction that makes use of input devices such as keyboards, mouse, track-pad for communication needs natural communication between humans and machines. Jumping from feature phones to touchscreen smart phones was a huge leap in technology. Time to make another leap, from touchscreen to touch-less. Gesture is a form of expression that involves movement of a part of the body, like the hand usually to communicate non-verbally. In a human interaction, we make use of speech, gestures like waving and body movements to convey information to other humans. So why not do that with computers too? As computer technology grows rapidly, the need for natural communication between humans and computers also increases. Although our mobile devices make use of the touch screen technology, it is not cheap enough to be implemented in desktop systems.The method proposed in this paper makes use of a night vision camera through which gestures imparted by the user are captured in real time, processed and the function related to that gesture is executed. For example, a gesture “index finger pointed upwards”, could be predefined in the system to increase volume of the system .The system has four phases namely, live image capturing, image pre-processing, module extraction, gesture recognition and task execution. Module extraction involves extracting features of the hand image such as hand contours (gaps between fingers). Gesture recognition involves recognizing hand gestures with the help of extracted features. Task execution simply means performing the action with response to the gesture being given.

II. LITERATURE SURVEY

Referring various International Journals along with our previous version of the project, we tried to enhance our project. Here are few limitations that a few journals had to which we proposed our solution to make our model even more robust.

[1] In this paper, they propose a method for fingertip detection and hand gesture recognition in real-time using an RGB-D camera and a 3D convolution neural network (3DCNN). This system can accurately and robustly extract fingertip locations and recognize gestures in real-time. They show accurateness and robustness of the interface by evaluating hand gesture recognition across various gestures. In this paper presented to hand gesture recognition it can’t expand the system to handle more hand gestures and apply our method in more other practical applications.We proposed a solution to add multiple gestures.

[2] For indoor applications if we could control the path of the robot using gesture and clap sounds. In this composition, this work proposes and implements an advanced method to control mobile robots in real-time using short adjustment of clap sound and hand gesture commands from Microsoft Kinect sensor linked to a laptop/PC and mobile robot is connected via RF link. Proposed solution: We will use the python script to make tasks quickly in PC.

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[3] AirMouse: Finger gesture for 2D and 3D interaction Michael Ortega, Laurence Nigay IFIP Conference on Human-Computer Interaction, 214-227, 2009 This paper presents AirMouse, a new interaction technique based on finger gestures above the laptop's keyboard. At a reasonably low cost, this technique can replace the ancient methods for pointing in2 or 3 dimensions. However, the device-switching time is reduced and no additional surface than the one for the laptop is required. The 2 user experiments demonstrate the benefits of themulti-valent technique: it is simple to learn, intuitive and efficient by giving good performance. In particular, our conducted experiment shows that performance with a Proposed solution : We used 3D real time gestures which solves the problem.
[4] The recognized gestures are used to generate motion control commands to the low-level DSP motion controller so that it can control the motion of the RoboChair according to the user's intention.Proposed Solution: So to overcome this problem we will use VL530X Distance sensor . This will increase the range.
[5] These images are captured with a normal camera. These hand images are taken under the same condition. The background of these images is identical. So, it is easy and effective to detect the hand region from the original image using the background subtraction method.we will use Hand detection sensor to detect the whole hand.
[7] Simple multi-touch gesture usability and performance in laptop computers Atte Heinikoski The subject of this research is measuring the usability and performance of multi-touch gesture recognition in laptop computers. We have used touch-less Gestures.
[10] We learn the gesture detection from this paper, the basic need of our program.
In order to execute action from a gesture, our system first needs to identify it. Although this model is good recognizing the gesture, it does nothing to perform any tasks. We have solved that problem in our methods.

III. PROBLEM DEFINITION

There are many applications where hand gestures can be used for interaction with systems like, video games, controlling UAVs, medical equipment, etc. These hand gestures can also be used by handicapped people to interact with the systems. Classical interactions tools like keyboard, mouse, touchscreen, etc. may limit the way we use the system. All these systems require physical contact, in order to interact with the system. Gestures can interpret the same functionality without physically interacting with the interfacing devices. The problem lies in understanding these gestures, as for different people, the same gesture may look different for performing the same task. This problem may be overthrown by the use of OpenCV library, one of python modules proving to be the ultimate tool to process such recognition systems. High computing power is required in order to process gestures.

IV. IMPLEMENTED SOLUTION

Upon doing a lot of research and study, we came up with a solution that can satisfy the problem statement. Make such a device that can identify specific gestures and manipulate the software with respect to the gesture made by the user. This technique helps the user to control the software without even touching the device that it is running on. A simple thumbs up is programmed to change the chrome tab is effortless to perform. For that we need a hardware that can detect the hand and understand the gesture and do the task with respect to the gesture. After doing some readings from previous attempted projects by people, we end up deciding to use Pi Cam . The feature of Pi Cam cam lets capture the gestures done by users.

A.Block Diagram

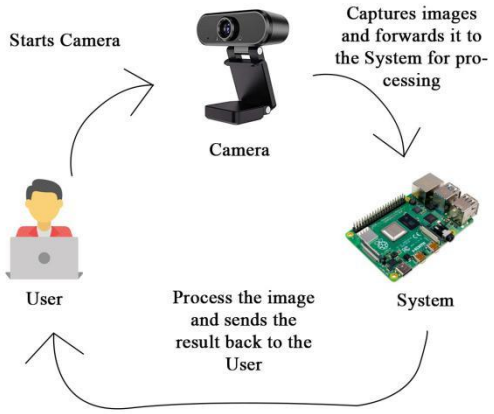

Fig. 1. *Basic architecture of the system*

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Live image is captured by the camera and sent to the Raspberry Pi. According to the program the image in the Area of interest, the image is converted from BGR to HSV. The live image is then resized to smaller resolution for efficient processing and then the python script converts the hand part of the image into white pixels and the background behind the hand is changed to black pixels. Each gesture has its own unique area ratio. On this basis all the gestures are differentiated from one another. Small amounts of noise and defects are decreased. The gap between fingers (contours) are found that helps the program to recognize how many fingers are held and further helps it to identify what gesture is being given, if matched then the following task for the respective gesture is executed. For eg. Showing one finger increases the volume of the system. Gestures can only be detected in the area of interest. Area of interest is a virtual box created for the sole purpose of gesture detection. Success rate of the gesture execution is increased if the user is keeping the hand perfectly in the chosen region area of interest.

V. HARDWARE DESCRIPTION

A. Raspberry PI Infrared IR Night Vision Surveillance Camera Module 500W Webcam

This camera is useful in daylight as well as in the low light environment. It features 5MP with OmniVision 5647 sensor which is in fixed focus mode and hence helps to focus on the region of interest in our code. The 5MP camera module is perfect for capturing hand images in reasonable details and the night vision on this camera allows us to use it in low-light situations too, just boot up the latest version of Raspbian and you are good to go.

B.Raspberry Pi4 Model B

Raspberry Pi 4 Model B is the most compatible product in the popular Raspberry Pi range of computers. It offers ground-breaking performance, processor speed, multimedia performance, memory and backwards compatibility. Since the code demands a fair amount of performance, this is a perfect match to make our code run on any system since all the processing part is done by Raspberry Pi4.

VI. SOFTWARE DESCRIPTION

Python 3.9.2

Python is an object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as being used as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. We have used a mix of both in-built and pip modules provided by python.

VII. ALGORITHM

1. User makes a gesture.
2. Pi cam sends the image to raspberry Pi.
3. BGR image is converted to HSV image.
4. Hand part of the image is converted into white pixels.
5. Background is changed to black pixels.
6. Some amount of noise and defects are reduced.
7. Pi Cam communicates with Raspberry Pi to inform about the gesture input by the user.
8. Raspberry Pi manipulates the program that the user wants to control from the respective gesture with the uploaded code.
9. Task successfully executed (using pyautogui) just by doing a gesture.

VIII. ADVANTAGES

- Super easy to use once implemented successfully.
- Dynamic. Can be programmed to manipulate any program.
- Gestures based, so it can be used without touching the device.
- Works in night mode (low light environment)
- Base model for further advanced technology.
- No authorization required.
- It is not user specific, so any hand can be used to execute a task using gesture.

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IX. APPLICATIONS

- Medical field
- Consumer Electronics
- Entertainment
- Simulation related application
- Augmented Reality (on very advance level implementation

X. ACKNOWLEDGEMENT

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XI. RESULT AND DISCUSSION

We succeeded in creating such a system that can manipulate computer tasks just by showing a gesture. Not only that, but the gestures work with any hand provided the skin tone of the user is in a range of our inputs. If not, that problem can also be solved by making a custom script for that specific user. Otherwise the system is dynamic and robust. So let's discuss the accuracy of each gesture that our system supports.

Gesture 5 :

Gesture 5 works 47/50 times accurately and also performs the action ie. Scroll down. So gesture 5 works with 94% accuracy.

Gesture 4 :

Gesture 4 works 41/50 times accurately and also performs the action ie. Scroll up. So gesture 4 works with 82% accuracy.

Gesture 3 :

Gesture 3 works 50/50 times accurately and also performs the action ie. play/pause. So gesture 3 works with 100% accuracy.

Gesture 2 :

Gesture 2 works 44/50 times accurately and also performs the action ie. Volume down. So gesture 2 works with 88% accuracy.

Gesture 1 :

Gesture 1 works 45/50 times accurately and also performs the action ie. Volume up. So gesture 1 works with 90% accuracy.

A point should be noted that the accuracy of the gesture detection may vary with respect to the lightning in the room and the background behind the region of interest. The gestures also depend on the camera quality. Better the camera, detailed live images are captured, processing is much more effective and hence resulting in better accuracy.

XII. LIMITATIONS AND FUTURE WORK

Implementation of such a project is very complicated to set up. But once it is set up and ready to go, it is very easy to use after that. Apart from the complication of the sheer implementation of the system, the background behind the user plays a huge role and affects the accuracy of gestures detection. If the color of the background behind the user is close to the color of skin, then the system will take false inputs and become unstable. In future work we need to solve this problem so that the camera only accepts the hand skin color and rejects all the skin-resembling background colors. Furthermore, we will be adding more gestures to perform even more tasks.

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XIII. CONCLUSION

To make life more convenient, sensors that monitor body vitals and functions are actively developed nowadays. Our method uses different simple gestures to make it easier to browse a website or control any electronic device or play some interactive games. This paper describes a system that manipulates computer applications with the help of hand gestures. The method proposed here will successfully create a hand gesture recognition system that is able to recognize which gesture is performed by the user and accurately perform the functionality associated with it. Presently, the camera, Raspberry Pi, is an integral part of the computer system. Our product which uses only a camera would completely eliminate the keyboard and mouse. Also this would lead to a new era of Human Computer Interaction (HCI) where no physical contact with the device is required.

REFERENCES

[1] Starner,T.; Pentland, A. Real-time american sign language recognition from video using hidden markov models. In Motion-Based Recognition; Springer: Berlin/Heidelberg, Germany, 1997; pp. 227–243.
[2] Jaemin Lee, Takimoto Hironori, Yamauchi Hitoshi, Kanagawa Akihiro and Mitsukura Yasue, "A Robust Gesture Recognition based on Depth Data", The 19th Korea -Japan Joint Workshop on Frontiers of Computer Vision, pp. 127-131, 2013.
[3] Mohamed Abdulaziz Ali Haseeb, Ramviyas Parasuraman IEEE Sensors Journal 19 (1), 257-267, 2018
[4] JO Gray, Pei Jia, Huosheng H Hu, Tao Lu, Kui YuanIndustrial Robot: An International Journal, 2007
[5] R. Harshitha, I. A. Syed, and S. Srivasthava, “Hci using hand gesture recognition for digital sand model,” in Proceedings of the 2nd IEEE International Conference on Image Information Processing (ICIIP '13), pp. 453–457, 2013.
[6] Luke St Clair US Patent 9,298,295, 2016 BACKGROUND
[7] M.K. Bhuyan, P.K. Bora, and D. Ghosh, ―Trajectory Guided Recognition of Hand Gestures having only Global Motions‖ World Academy of Science, Engineering and Technology 21 2008
[8] Gabe Cohn, Daniel Morris, Shwetak N Patel, Desney S Tan Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 791-800, 2011
[9] User interaction gestures with virtual keyboard Steven S Bateman, John J Valavi, Peter S Adamson US Patent App. 12/800,869, 2011.
[10] Ali A Alani, Georgina Cosma, Aboozar and T M McGinnity, "Hand Gesture Recognition Using an Adapted Convolutional Neural Network with Data Augmentation", IEEE International Conference on Information Management, 2018.

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