IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ARTIFICIAL INTELLIGENCE - POWERED VOICE ASSISTANT AND HAND GESTURES CONTROLLED GAME AND VIRTUAL MOUSE

[1]Jeevika R, [2]Jairaameelevarune N, [3]Hemashree K [4]Kasthuri M

[1]Student, [2]Student, [3] Student, [4]Assistant Professor

[1]Department Of Computer Science and Engineering, [1,2,3,4]Adhiyamaan College Of Engineering, Hosur, Tamil Nadu

Abstract: Human-computer interaction is becoming more popular owing to its automaticity, naturalness, and user-friendly characteristics. An innovative approach to this explores by integrating artificial intelligence (AI) with hand gestures and voice commands to revolutionize human-computer interaction in game and virtual mouse, introducing voice-activated functionalities called proton. This system aims to reduce the need of physical device interaction by leveraging computer vision with OpenCV and Python, utilizing only a webcam as an input tool. Instead of using more expensive sensors, a simple webcam can identify the gesture and perform the action. The proposed framework allows users to perform game operations like left move, right move, up, stop. virtual mouse operations like left click, right click, double click, scrolling, drag and drop, volume control and brightness control through various hand gestures, and also users can perform find locations on Google Maps, check the current date and time, put Proton to wake it up, and exit the system, and perform tasks effortlessly through intuitive voice commands. Real-time applications, particularly in gaming, benefit from this approach, overcoming barriers associated with traditional input devices. Testing on games achieve human-computer interaction with minimal hardware requirements. This system integrates AI powered hand gestures and voice commands, demonstrates promising results in enhancing user experiences in virtual environments for gaming and mouse control._A significant advancement in human-computer interaction, providing an innovative and user-friendly interface. This seamless integration of AI and gesture control sets a new standard for efficiency, accessibility in interactive computing experiences.

Index Terms - Artificial Intelligence (AI), Machine Learning, Human-Computer Interaction (HCI), OpenCV, Mediapipe, Natural Language Processing (NLP), Speech recognition.

I. INTRODUCTION

In today's digital era, human-computer interaction (HCI) has become increasingly prevalent, driven by the demand for automaticity, naturalness, and user-friendly interfaces. This burgeoning field has prompted innovative approaches, including the integration of artificial intelligence (AI) with hand gestures and voice commands, aimed at revolutionizing HCI in gaming and virtual mouse control applications. Real-time applications particularly in gaming, which stand to benefit significantly from this approach, as it overcomes barriers associated with traditional input devices. It can be enhanced for a more intuitive and convenient experience through the integration of hand gestures. A virtual mouse is a software application that enables users to control mouse inputs to a system without the need for a traditional mouse or mouse pad. The webcam-based virtual mouse employs different image processing techniques to interpret the hand movements of a user into mouse inputs. A voice assistant is an advanced software program designed to respond to voice commands

and perform tasks or provide information for users. Utilizing natural language processing (NLP) and artificial intelligence (AI), voice assistants are capable of understanding and interpreting spoken language to execute various functions. Voice assistants are typically activated by a wake word or phrase, after which users can issue commands or ask questions verbally. The assistant then processes the input, generates a response, and carries out the requested action or provides the relevant information. In essence, the seamless integration of AI and gesture control for interactive computing experiences, ushering in a new era of efficiency and accessibility.

II. RELATED WORK

[1] Pooja Kumari, Ghaziabad Saurabh Singh, Ghaziabad Vinay Kr. Pasi. Users can navigate the cursor by moving their hands adorned with color caps or tapes, while various gestures perform different mouse functions like clicks and scrolls. Utilizing only a low-resolution webcam, the system tracks hand movements in two dimensions and can interpret up to five distinct gestures, offering an intuitive and accessible interface for computer interaction.

[2] Vijay Kumar Sharma, Vimal Kumar, Md. Iqbal, Sachin Tawara, Vishal Jayaswal. This method is to control cursor movement using hand gestures exclusively, eliminating the need for additional electronic devices. Various actions such as clicking and dragging

will be executed through different hand gestures. The system relies solely on a webcam as input, with software components utilizing
OpenCV and Python libraries like NumPy, math, wx, and mouse. Users can calibrate the system using the camera output displayed on the screen for precise interaction.

[3] Anadi Mishra, Sultan Faiji, Pragati Verma, Shyam Dwivedi, Rita pal. This project leverages Human-Computer Interaction principles to enable control of a video display through hand gestures, using technologies like Mediapipe for hand tracking, OpenCV for image processing and drawing, and Autopy for mouse movement control. By employing these algorithms, users can interact with their screens by simply moving their fingers, effectively transforming hand gestures into cursor movements for intuitive control.

[4] Lorena Isabel Barona Lopez, Cesar Israel Leon Cifuentes, Jose Miguel Munoz Ona, Angel Leonardo Valdivieso Caraguay. A hand gesture recognition system using CNN-LSTM neural networks and the CRISP-ML(Q) model identified 11 gestures with EMG and IMU signals. Integrated into a video game, the system earned a positive SUS score of 75, reflecting successful merging of software engineering and machine learning principles for intuitive gesture-based interaction.

[5] Nhat Vu Le, Majed Qarmout, Yu Zhang, Haoren Zhou, Cungang Yang. The Hand Gesture Recognition System for Games utilizes a computer's webcam to interpret real-time hand gestures as virtual gamepad inputs, offering an affordable and inclusive solution for gamers with physical disabilities. With fast image processing using OpenCV, the program enables customizable, low-latency control across various game genres through direct communication with games.

III. OBJECTIVE

The aim is to revolutionize human-computer interaction by seamlessly integrating artificial intelligence into hand gesture recognition systems, enhancing user experience through intuitive and natural methods. This technology enables effortless execution of game and virtual mouse operations, reducing reliance on traditional physical input devices. By leveraging computer vision real-time applications particularly in gaming and mouse operations can overcome limitations of conventional input devices. Through innovative gameplay mechanics, hand gestures offer responsive and intuitive controls, enhancing the overall gaming experience. Additionally, the development of voice-activated functionalities, called "Proton," empowers users to effortlessly initiate tasks through natural language commands. This integration of AI into voice assistants further enhances user interaction, allowing various tasks. Promoting the adoption of hand gesture-controlled systems highlight the numerous benefits and potential applications across various computing environments.

IV. RESEARCH METHODOLOGY

4.1 Software Setup and Integration:

Configure the development environment with the necessary software tools and libraries, including OpenCV, Python required for gesture recognition. Also Integrate speech recognition libraries/APIs to enable voice command functionalities within the system.

4.2 Technologies and Tools:

OpenCV Used for real-time video processing. Machine Learning Models employed for hand landmarks detection and hand gesture recognition, potentially utilizing pre-trained models like MediaPipe.

OpenCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. This library is written in the python language and it helps in the making of applications that used computer vision. The developing of hand gesture recognition using Python and OpenCV can be implemented applying the hand detection system. OpenCV is essential for processing video input from the webcam, performing hand gesture recognition for each position of the fingers. OpenCV library is utilized for image and video processing and for detecting and analyzing objects.

Hand Gesture recognition

Hand gesture recognition is a field of computer vision and machine learning focused on interpreting hand movements and positions to understand gestures made by humans. It focuses on recognizing and interpreting hand gestures captured by the webcam using computer vision techniques. The system analyzes their spatial configurations and movements to recognize specific gestures performed by the user. Hand Gesture recognition algorithms interpret the sequence and arrangement of landmarks to classify gestures accurately. Real-time systems can be built using frameworks like MediaPipe, which provide pre-trained models for hand tracking and gesture recognition. It encompasses a diverse range of algorithms tailored to identify intricate hand movements, including gestures for gaming control, virtual mouse operations and system controls. The Hand Gesture Recognition represents a significant advancement in interactive computing, offering users intuitive and immersive experiences in virtual environments.

Mediapipe

MediaPipe is a powerful computer vision framework to build machine learning-based applications. It provides a comprehensive library of pre-built models and tools for processing multimedia data such as images, videos. It offers pre-trained models and pipelines

for tasks like hand tracking and detection. The MediaPipe recognize hand gestures in real time, and provides the recognized hand
gesture results along with the landmarks of the detected hands. This is to recognize specific hand gestures from a user, and invoke application features that correspond to those gestures. Developers can leverage Mediapipe's APIs and pipelines to incorporate advanced machine learning capabilities into their applications without the need for extensive expertise in machine learning or computer vision. It simplifies the development process and accelerates the deployment of AI-powered solutions. This innovative technology has the potential to revolutionize the way that interact with digital devices and create a more intuitive and immersive user experience.

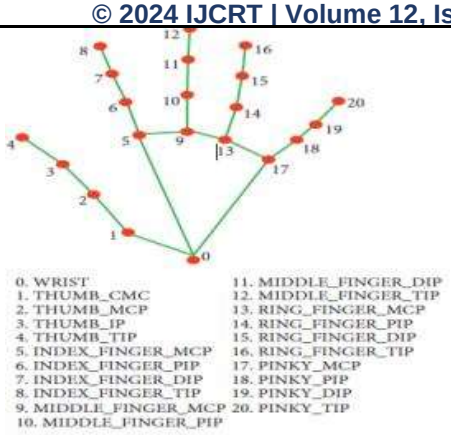


Figure 1. Hand landmark detection

Speech recognition library:

A speech recognition library in Python is required to process voice commands from the user. SAPI5 stands for Speech Application Programming Interface 5. It is a standard developed by Microsoft for speech synthesis and recognition on Windows operating systems. SAPI5 provides a set of APIs (Application Programming Interfaces) that can use to integrate speech functionality into the Proton application. This includes text-to-speech (TTS) synthesis, which converts written text into spoken words, and speech recognition, which allows applications to understand and respond to spoken commands.

4.3 Architecture Design:

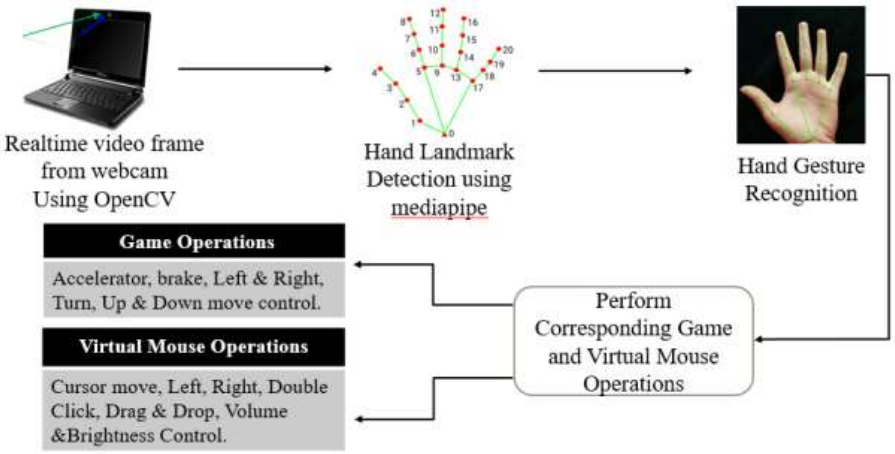


Figure 2. Architecture Design For Game & Virtual Mouse

From the above *Figure 2.* integrates artificial intelligence (AI) with hand gestures for game to redefine human-computer interaction within virtual environments.

The architecture begins with capturing real-time video frames that are continuously captured from a webcam connected to the system. These frames serve as input data for subsequent processing stages. And fed into the hand landmarks detection, utilizing computer vision techniques the system detects and identifies landmarks on the user's hand within the video frames. It involves identifying key points and features on the hand, which serve as reference points for gesture recognition. Once hand landmarks are detected, the system analyzes their spatial configurations and movements to recognize specific gestures performed by the user. Hand
Gesture recognition interpret the sequence and arrangement of landmarks to classify gestures by using mediapipe. The recognized hand gestures are mapped to corresponding game control operations such as accelerator, brake, left turn, and right turn. This mapping allows users to intuitively control the game environment using hand movements captured by the webcam. And for virtual mouse,

the recognized hand gestures are mapped to corresponding virtual mouse control operations such as Left click, Right click, Double Click, Neutral Gesture, Cursor Move, Scrolling, Drag and Drop, Multiple item Selection, Volume Control, Brightness Control. This mapping allows users to intuitively control the Virtual mouse environment using hand movements captured by the webcam.

VOICE ASSISTANT ARCHITECTURE (PROTON)

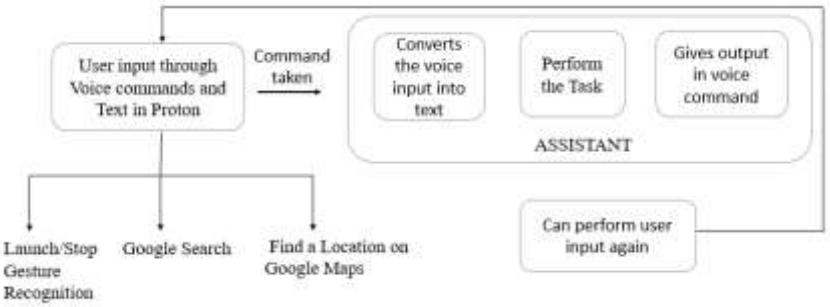


Figure 3. Architecture For Voice Assistant (Proton)

From the above *Figure 3.* integrates (AI) with voice assistant to redefine human-computer interaction. The architecture of Proton enables seamless user interaction through voice commands and text input for various tasks such as Launch/Stop Gesture Recognition, Google Search, Find a location on Google Maps, File Navigation, Current Date and Time, Copy and Paste, Sleep/Wakeup Proton and Exit. Users initiate interactions either vocally or via text, with the system converting voice input to text using speech recognition algorithm. This system executes the requested task based on the identified command and provides output to the user in the form of voice commands or textual responses, depending on the nature of the task and user preferences. Proton's feedback loop mechanism allows for iterative interactions, enhances user engagement and intuitive experience.

V. RESULT

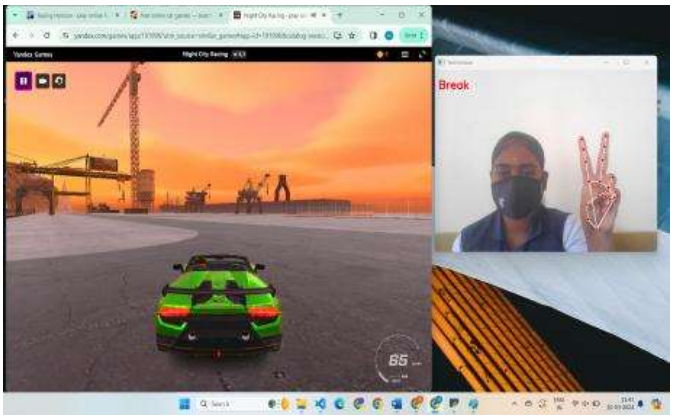
The HCI (Human Computer Interaction) and computer vision based interaction between the machine and human. The proposed paper is on controlling game and mouse functions using hand gestures. The results of hand gestures controlled games and virtual mouse interactions depend on the responsiveness of the hand gesture recognition system.

In an ideal scenario, players should experience seamless and intuitive control over game actions and virtual mouse movements through natural hand gestures. The Performance obtained for hand gestures controlled games such as the car and bike game is shown in the Figure 4,5,6. It performs the gaming functions such as accelerate, brake, Left turn, Right turn. And the performance obtained for hand gestures controlled virtual mouse is shown in the Figure 7. It performs the mouse functions such as left click, right click, double click, scrolling, drag and drop, volume control and brightness control through various hand gestures. For example, raising your index finger might move the game character forward. This would result in enhanced immersion, improved gameplay experiences, and increased user engagement. However, the effectiveness of the system can vary based on factors such as the quality of the hand gesture recognition model, the complexity of the gestures mapped to game actions, and the user's proficiency in performing the gestures. Overall, successful implementation of hand gestures controlled games and virtual mouse interactions can offer innovative and enjoyable ways for users to interact with digital environments.

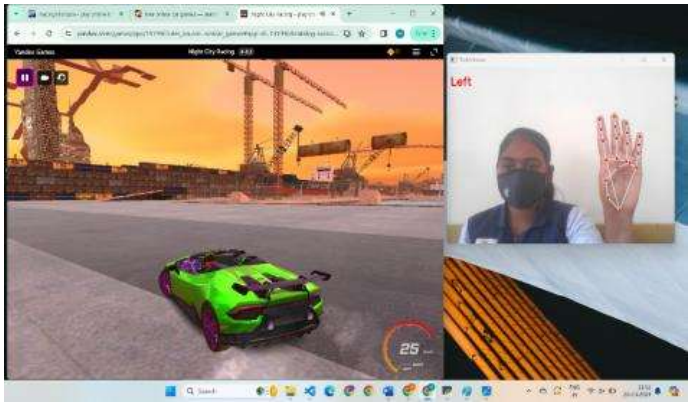
The results of voice assistant would ideally provide users with seamless and efficient control over various system functionalities through voice commands. It is shown in the Figure 8. Users should experience recognition of spoken commands, prompt execution of tasks, and clear feedback or responses from the system. Additionally, the voice assistant should adapt to users' preferences and speech patterns over time, improving its responsiveness through machine learning algorithms. The success of the voice assistant hinges on its ability to enhance user productivity, streamline interaction with the system, and provide a convenient and intuitive interface for accessing information and performing tasks.

ACCELERATE

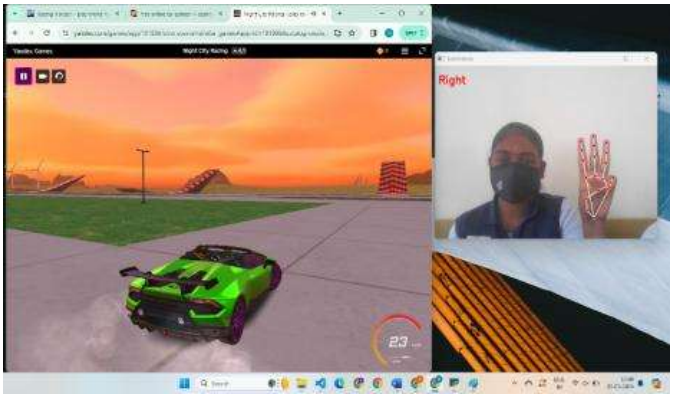
BRAKE



LEFT TURN



RIGHT TURN



ACCELERATE

BRAKE

RIGHT TURN

LEFT TURN

Figure 4. Gaming Operations Using Hand Gesture Controlled for Car and Bike Game

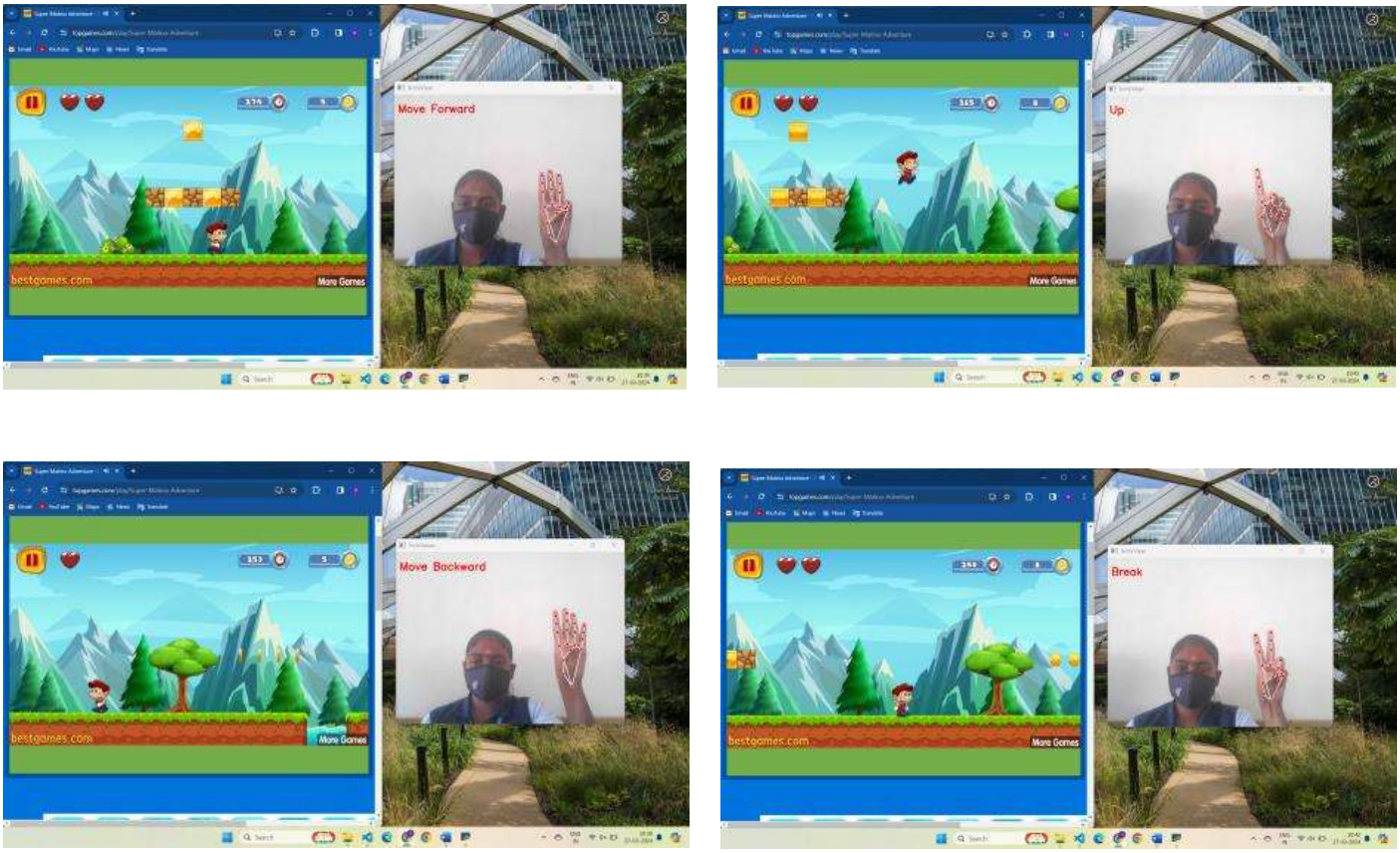


Figure 5. Gaming Operations Using Hand Gesture Controlled for Mario Game

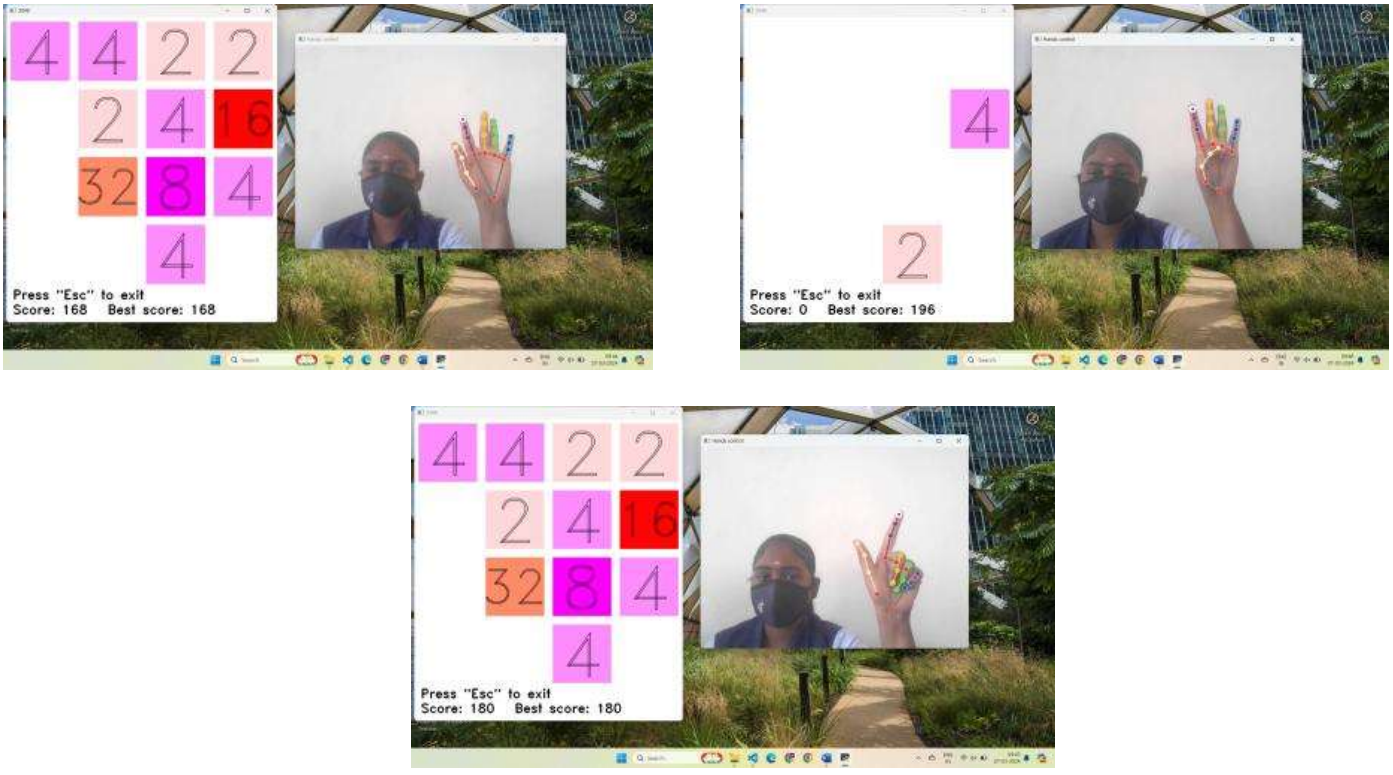


Figure 6. Gaming Operations Using Hand Gesture Controlled for 2048 Game

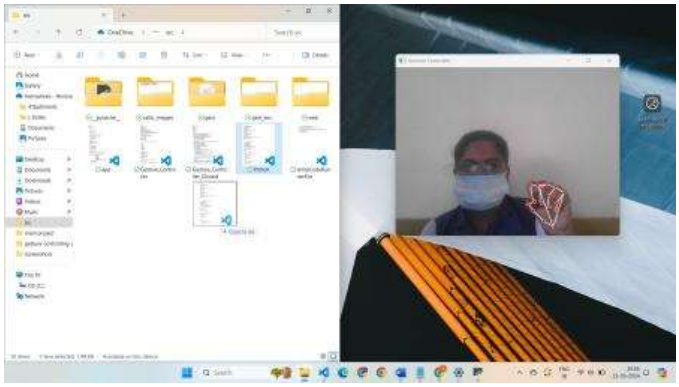
CURSOR MOVE

LEFT CLICK

RIGHT CLICK

DOUBLE CLICK

DRAG & DROP



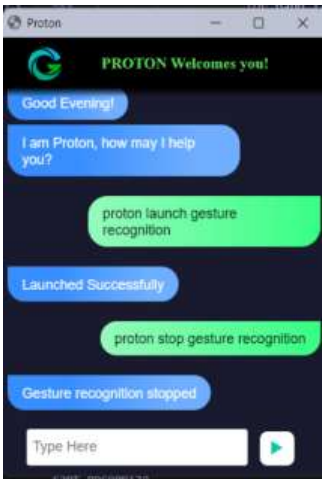
MULTIPLE ITEMS SELECTION

VOLUME CONTROL

NOTHING

Figure 7. Virtual Mouse Operations Using Hand Gesture Controlled

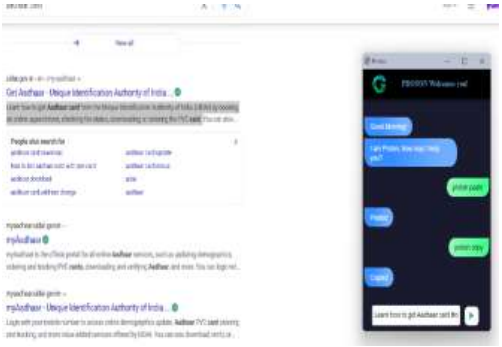
LAUNCH/STOP GESTURE RECOGNITION



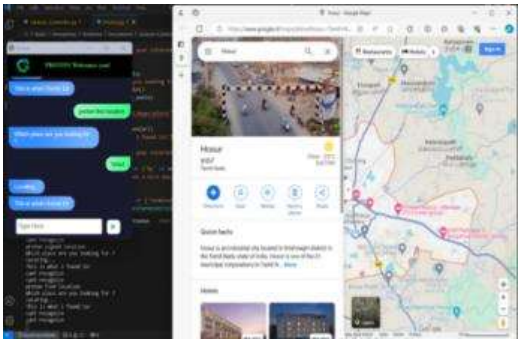
CURRENT DATE/TIME

FILE NAVIGATION(LIST FILES)

COPY/PASTE



FIND A LOCATION ON GOOGLE MAPS



GOOGLE SEARCH

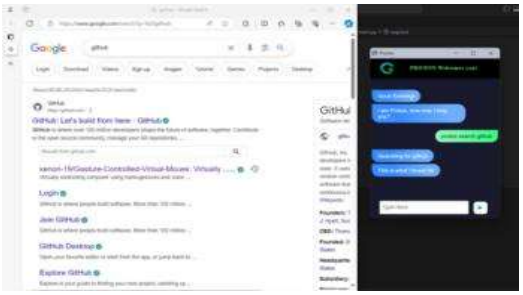


Figure 8. Voice assistant functions (Proton)

V. CONCLUSION

This system embodies a pioneering approach to human-computer interaction, seamlessly blending artificial intelligence with intuitive hand gestures for games, virtual mouse and voice commands. By harnessing the power of computer vision through OpenCV and Python. In real-time applications particularly in gaming, promise to transcend the limitations of traditional input devices instead of using expensive sensors, enhancing user experiences and redefining the way that interact with technology. It enables users to effortlessly navigate virtual environments, perform tasks, and control applications with unprecedented ease. Also represents a significant leap forward in human-computer interaction, offering an innovative and user-friendly interface that sets a new standard for efficiency and accessibility in interactive computing experiences.

REFERENCE

[1] Amin, K. Ismail, A. Nugroho, and S. Kaleg, ‘‘Passive balancing battery management system using MOSFET internal resistance as balancing resistor,’’ in Proc. Int. Conf. Sustain. Energy Eng. Appl. (ICSEEA), Jakarta, Indonesia, Oct. 2021, pp. 151–155.

[2] B. S. Sagar, B. P. Divakar, and K. S. V. Prasad, ‘‘Series battery equalization using sequential difference algorithm,’’ in Proc. Int. Conf. Adv. Electron. Comput. Commun., Oct. 2021, pp. 1–6.

[3] Cai, W.; Wang, H.; Maleki, H.; Howard, J.; Lara-Curzio, E. Experimental simulation of internal short circuit in Li-ion andLi- ion-polymer cells. J. Power Sources 2020,196, 7779–7783.

[4] C. Piao, Z. Wang, J. Cao, W. Zhang, and S. Lu, ‘‘Lithium-ion battery cellbalancing algorithm for battery management system based on real-time outlier detection,’’ Math. Problems Eng., vol. 2021.

[5] D. N. How, M. A. Hannan, M. H. Lipu, and P. J. Ker, ‘‘State of charge estimation for lithium-ion batteries using model-based and data-driven methods: A review,’’ IEEE Access, vol. 7, pp. 136116–136136, 2019. [15] A. Tavakoli, S. A. Khajehoddin, and J. Salmon, ‘‘A modular battery voltage-balancing system using a series-connected topology,’’ IEEE Trans. Power Electron., vol. 35, no. 6, pp. 5952–5964, Jun. 2020.

[6] G. L. Plett, ‘‘Extended Kalman filtering for battery management systems of LiPB-based HEV battery packs part 1. Background,’’ J. Power sources, vol. 134, pp. 252–261, Aug. 2021.

[7]J. Xu, X. Mei, and J. Wang, ‘‘A high power low-cost balancing system for battery strings,’’ Energy Proc., vol. 158, pp. 2948– 2953, Feb. 2019.

[8] L. A. Perisoara, I. C. Guran, and D. C. Costache, ‘‘A passive battery management system for fast balancing of four LiFePO4 cells,’’ in Proc. IEEE 24th Int. Symp. Design Technol. Electron. Packag. (SIITME), Iasi, Romania, Oct. 2021, pp. 390–393.

[9]Larsson, F.; Mellander, B.E. Abuse by External Heating, Overcharge and Short Circuiting of Commercial Lithium-Ion BatteryCells. J. Electrochem. Soc. 2020,161,

[10]Leising, R.A.; Palazzo, M.J.; Takeuchi, E.S.; Takeuchi, K.J. Abuse testing of lithium-ion batteries: Characterization of the overchargereaction of LiCoO2graphite cells. J. Electrochem. Soc. 2021,148, A838.

[11]Lin, C.K.; Ren, Y.; Amine, K.; Qin, Y.; Chen, Z.H. In situ high-energy X-ray diffraction to study overcharge abuse of 18650- sizelithium-ion battery. J. Power Sources 2019,230, 32–37.

[12] M. Daowd, M. Antoine, N. Omar, P. Lataire, P. Van Den Bossche, and J. Van Mierlo, ‘‘Battery management system— Balancing modularization based on a single switched capacitor and bi-directional DC/DC converter with the auxiliary battery,’’ Energies, vol. 7, no. 5, pp. 2897–2937, Apr. 2021.

[13] Orendorff, C.J.; Roth, E.P.; Nagasubramanian, G. Experimental triggers for internal short circuits in lithium-ion cells. J. PowerSources 2019,196, 6554–6558.

[14] S. R. Dos Santos, J. P. V. Fracarolli, A. Y. M. Narita, J. C. M. S. Aranha, F. L. R. Marques, J. C. Sansao,

and P. V. B. Hamacek, ‘‘Dissipative lithium-ion cell balancing by recharge control and detection of outliers for energy optimization and heat reduction,’’ in Proc. 44th Annu. Conf. IEEE Ind. Electron. Soc. (IECON), Washington, DC, USA, Oct. 2019, pp. 5038–5043.

[15] Saito, Y.; Takano, K.; Negishi, A. Thermal behaviors of lithium-ion cells during overcharge. J. Power Sources 2021,97, 693– 696.