JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Hands-free gesture controlled ordering APP advanced analytics and computer vision

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Abstract : Amidst the once all-encompassing COVID-19 pandemic, the necessity for touch-less interaction solutions has become increasingly apparent. In Response, this paper introduces a novel hand-free gesture-controlled application designed to address this need effectively. This hand-free gesture-controlled application represents a significant step forward in touch-less technology, particularly in the context of the COVID-19 pandemic. It not only provides a practical solution to current challenges but also promotes broader societal awareness and inclusiveness. As we navigate these uncertain times, innovations like these play a crucial role in shaping a safer, cleaner, and more connected future.

***IndexTerms* - Gesture Prediction, Predictive Analytic, Computer Vision, Machine Learning**

I. INTRODUCTION

The hands-free gesture control initiative represents a significant endeavor aimed at redefining user interaction through innovative technology. In today's digital landscape, the demand for intuitive and efficient interfaces is ever growing, prompting a shift towards solutions that transcend traditional input methods.Recognizing the limitations of conventional interfaces, this initiative endeavors to leverage advanced technologies such as computer vision and gesture recognition to create a seamless user experience. Whether it's navigating through applications, controlling devices, or interacting with digital content, the ability to effortlessly execute commands through gestures offers a new dimension of convenience and accessibility. Through intuitive gesture mapping and insightful analytics, this initiative aims to enhance user productivity and streamline everyday tasks, ultimately revolutionizing the way we interact with technology. By providing users with a more natural and seamless interface, it seeks to bridge the gap between human cognitive capabilities and digital systems, fostering a more efficient and effective environment.Also to introduce factors to reduce noise during processing such as movement constants and dynamic movement capabilities while applying low noise filters in radio signals to handle additional noise and reducing the interference speed. By leveraging gestures as a natural language to offer intuitive and immersive experiences across various applications. With ongoing advancements in machine learning and sensors, the future holds boundless possibilities for further innovation in this transformative technology, revolutionizing how we interact with devices and systems.

II. LITERATURE SURVEY

[1]"YOLBO: You Only Look Back Once: Low Latency Object Tracker Based on YOLO and Optical Flow," IEEE Access, vol. 9, 2021. The model integrates YOLO and Optical Flow, ensuring low latency in object detection and tracking. However, the study highlights that the feature extraction capability is weaker compared to other models.

[2] "Online Action Detection in Surveillance in Multi-Object Tracking Methods" by IEEE Access, vol. 11, 2023 states that deep learning-based multi-object tracking models perform significantly better than motion-based models when handling specific dataset clusters. However, it notes that these methods tend to suffer from slower inference speeds.

[3]"A Review on Machine Learning Styles in Computer Vision—Techniques and Future Directions," IEEE Access, vol. 10,2022 discusses the performance of various machine learning models and highlights that transfer learning implementations show the best results for model adaptability across tasks.

[4]"GUI Widget Detection and Intent Generation via Image Understanding," IEEE Access, vol. 9,2021,explores how machine learning techniques enhance widget detection and UI processing. The study concludes that transfer learning is effective for widget detection, and that simpler widgets improve evaluation efficiency, though this comes at the cost of reducing UI attractiveness.

[5]"Real-Time Adaptation of Context Aware Intelligent User Interfaces, for Enhanced Situational Awareness," IEEE Access, vol. 10,2022,introduces situational awareness (SA) techniques in device interfaces, improving user experience in various environments. However, the study notes a limitation—the system considers only the type of information, rather than its full content and context.

[6] "COVID-19: A Global Health Crisis," IEEE Access, vol. 52, 2023,an extensive review of the impact of COVID-19 globally. The paper discusses various perspectives, including the spread of the virus, medical advancements, and governmental responses.

However, the study acknowledges that it has a limited scope in addressing all knowledge areas comprehensively.
[7] "Performance Evaluation of Various Histogram Equalization Techniques on Thermal Images," in 2023 IEEE International Conference on Computer Vision and Machine Intelligence evaluates histogram equalization-based enhancement methods for thermal imaging, emphasizing applications in surveillance and medical imaging. However, it notes that the analysis does not include deep learning-based enhancement techniques, which might offer superior performance.

[8]".csv-based Workflow in MongoDB for Data Analysts," in 2023 IEEE 32nd International Symposium on Industrial Electronics (ISIE), 2023.MI), 2023,examines the integration of .csv files with MongoDB, enabling data analysts to work efficiently with structured data. The approach promotes collaboration among technical and non-technical users. However, the study highlights a drawback—its limited focus on non-tabular data types, such as JSON and XML.

[9] "Signal-to-Noise Ratio and Mean Square Error Improving Algorithms Based on Newton Filters for Measurement ECG Data Processing," in 2021 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (ElConRus), 2021.introduces an innovative approach to applying Newton filters for better noise reduction in electronic signals. Despite the promising performance improvements, the research notes that general adoption is limited due to the algorithm's lack of generalizability across diverse conditions.

III. METHODOLOGY

The process of developing a hands-free motion tracking system involved careful planning and the integration of multiple technologies, including data collection, environmental analysis, computer vision, machine learning, and user interface design. To begin, we compiled a diverse dataset that captured motion patterns, environmental conditions, and historical movement data from various sources, such as motion databases, sensor recordings, and simulations. We then refined and validated this data through rigorous preprocessing to ensure accuracy and reliability.

A key component of the system was computer vision, where we utilized algorithms like OpenPose to track skeletal movements in real time and analyze motion trajectories. Additionally, machine learning models played a crucial role in enhancing tracking accuracy. We experimented with different approaches, including support vector machines (SVMs) and recurrent neural networks (RNNs) to predict and adapt to user movements. By integrating all these technologies with an intuitive user interface, the system effectively optimized motion tracking, helping users manage tasks more efficiently and minimize distractions.

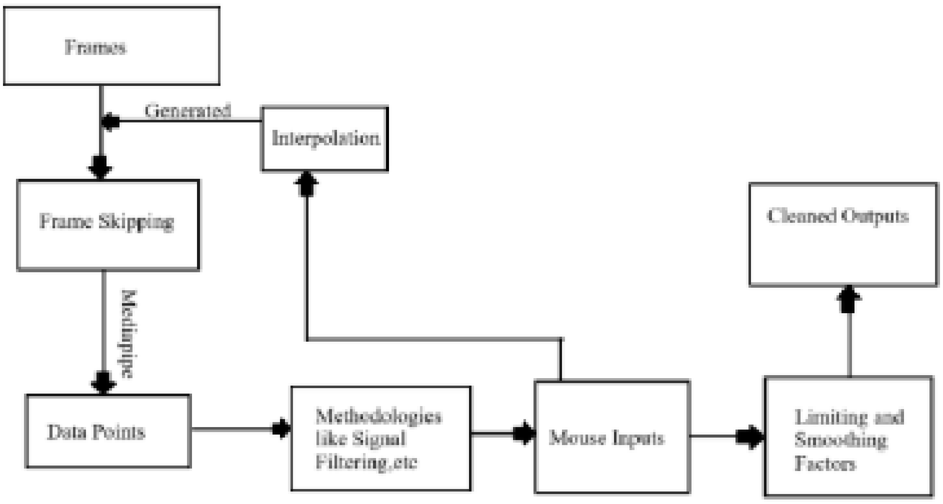

Fig. 1 Detailed Workflow

IV. FRAMEWORK DESIGN

1. One Euro Filter-The 1€ Filter is a real-time low-pass filter for reducing noise, with only two easy-to-configure parameters
Which stood out from other filtering technique traditional used not only due to ease of use but also for performance
The novel idea of utilizing it with a Matrix based output yielded better results than contemporary utilized techniques like Gaussian filtering

2. Interpolation-Utilizing it we can skip a lot of frames and generate the remaining frames using data we got

3. Signal Filtering-The Moving Average filter helps stabilize the movement by reducing the impact of sudden, small changes in position. Instead of relying solely on the most recent position, it considers the recent history, leading to smoother transitions in the object's trajectory.

4. Optical Flow Estimation-Optical flow estimation techniques, such as the Lucas-Kanade or Farneback method, are used to calculate the motion vectors of objects between consecutive frames in a video sequence. These methods enable the tracking of object movement and can be used for tasks like video stabilization, activity recognition, or visual odometry in robotics

5. Web Services and WebAssembly (Wasm) API-low level bytecode format it can be used in even low computationally powerful systems to do gesture tracking.

6. Webbrowser- To conduct a web search. Prefer choice is of Chrome since some tools break on chromium browsers

7. Mediapipe-To find the general location of the digits and to get the input data

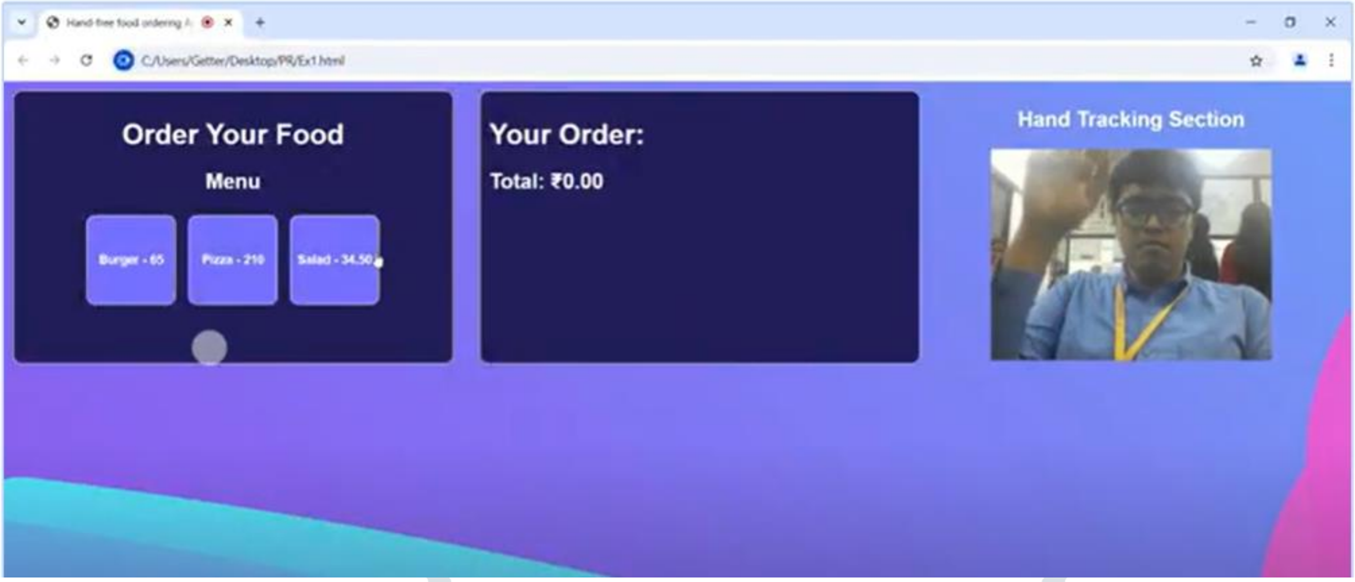

Fig. 3 Mouse Movement

V. RESULTS AND DISCUSSION

This system's implementation allows devices, even those not specifically designed for high graphical processing, to efficiently handle tasks like visual tracking. It enhances their processing capabilities, enabling them to perform visual data analysis and return the necessary results or actions related to these tasks. This improves the overall functionality and performance of the devices.

A. Technical Enhancements:

To develop a hands-free motion tracking system, we followed a structured approach that combined various technologies and optimization techniques. The first step was to gather a comprehensive dataset, incorporating motion patterns, environmental variables, and historical tracking data from multiple sources, such as sensor inputs and motion databases. We carefully processed and refined this data to ensure accuracy and consistency.To enhance performance, we applied frame skipping, a method commonly used in animation to improve efficiency without compromising smooth motion tracking. Additionally, we utilized signal filtering techniques to minimize ambient interference, ensuring the system functioned reliably across different environments.

Noise reduction was another critical focus area. By implementing movement constants and dynamic motion parameters, we improved tracking precision and eliminated erratic fluctuations. We also incorporated low-noise filters for radio signals, further reducing unwanted interference and enhancing overall system stability. By combining these techniques, we developed a robust motion tracking system that adapts to different environments, ensuring reliable hands-free control while maintaining high performance and minimal computational overhead.

B. Performance Metrics: The system’s performance was evaluated based on various parameters, including accuracy, speed, and efficiency. The results are summarized in the table below:

Table 1 Performance Evaluation

Metric	Result
Movement Recognition Accuracy	87 % under optimal conditions
Tracking Speed	0.2 to 0.6 sec under optimal conditions
Memory Consumption	600-800 mb

VI. CONCLUSION

In conclusion, hand gesture control instruments mark a significant advancement in human-computer interaction.

By leveraging gestures as a natural language, they offer intuitive and immersive experiences across various applications. With ongoing advancements in machine learning and sensors, the future holds boundless possibilities for further innovation in this transformative technology, revolutionizing how we interact with devices and systems.This proposed system enables contactless ordering, offering convenience for users on the go. Additionally, it has potential applications in VR gaming, where it can be integrated to enhance user interaction and optimize system performance by enabling intuitive, hands-free control in virtual environments.

REFERENCES

[1] Daniel S. Kaputa, Brian P. Landy, "YOLBO: You Only Look Back Once: Low Latency Object Tracker Based on YOLO and Optical Flow," IEEE Access, vol. 9, 2021.

[2]Jumabek Alikhanov, Hakil Kim, "Online Action Detection in Surveillance Scenarios: A Comprehensive Review and Comparative Study of State-of-the Art Multi-Object Tracking Methods," IEEE Access, vol. 11,2023

[3]Supriya Mahadevkar, Bharti Khemani, Shruti Patil, Ketan Kotecha, Deepali R. Vor, "A Review on Machine Learning Styles in Computer Vision —Techniques and Future Directions," IEEE Access, vol. 10,2022

[4]Penghua Zhu,Ying Li, TongyuLi, Wei Yang, Yihan Xu, "GUI Widget Detection and Intent Generation via ImageUnderstanding," IEEE Access, vol. 9,2021

[5]Zinovia Stefanidi, George Margetis, Stavroula Ntoa, George Papagiannakis, "Real-Time Adaptation of Context-Aware IntelligentUser Interfaces, for Enhanced Situational Awareness," IEEE Access, vol. 10,2022

[6]M.P.Moran,"COVID-19: A Global Health Crisis," IEEE Access, vol. 52, 2023.

[7]S.Singh,M.Sahil,B.Kumar and H.Singh," Performance Evaluation of Various Histogram Equalization Techniques on Thermal Images," in 2023 IEEE InternationalConference on Computer Vision and Machine Intelligence (CVMI), 2023.

[8]M. Fresta, A.Capello,F. Bellotti, L.Lazzaroni,M. Cossu, and R. Berta, "Supporting a .csv-based Workflow In MongoDB for Data Analysts," in 2023 IEEE 32nd International Symposium on Industrial Electronics(ISIE), 2023.

[9] Y. A. Altay and A. S. Kremlev, "Signal-to-NoiseRatio and Mean Square ErrorImproving Algorithms Based on Newton Filters For Measurement ECG Data Processing," in ElConRus, 2021.