

# HAND GESTURE BASED VIRTUAL CALCULATOR USING PYTHON FOR METAVERSE

Poornima R / Assistant Professor  
Department of Electronics and  
Communication Engineering  
SNS College of Technology  
Coimbatore, India

Elakkiya M P / UG Student  
Department of Electronics and  
Communication Engineering  
SNS College of Technology  
Coimbatore, India

Kannan S / UG Student  
Department of Electronics and  
Communication Engineering  
SNS College of Technology  
Coimbatore, India

Akash B / UG Student  
Department of Electronics and  
Communication Engineering  
SNS College of Technology  
Coimbatore, India

Dhilip R M / UG Student  
Department of Electronics and  
Communication Engineering  
SNS College of Technology  
Coimbatore, India

**Abstract —** *A calculator is an essential tool that helps user perform mathematical operations quickly and accurately. With advent of technology, calculators have become ubiquitous, and user can access them from various devices such as mobile phones, laptop and desktop computers. The virtual calculator we build will have a use-friendly interface that allows user to enter operands and operators using the hand gestures. The hand gesture-based virtual calculator using Python can be integrated with the metaverse, user can interact with virtual objects and environments using hand gesture, and the virtual calculator can be useful tool for performing calculations and solving problems. In addition, the hand gesture-based virtual calculator can be integrated with other objects and tools to create a more comprehensive metaverse experience. This system offers a user-friendly interface, with intuitive hand gesture and responsive calculator output.*

**Keywords—** *metaverse, virtual calculator, hand gesture*

## I. INTRODUCTION

The metaverse is an emerging technology that offers a new dimension of virtual experiences. In virtual world, user can interact with digital object in real-time, using a range of the input device such as hand gesture, voice recognition, and eye tracking. Hand gesture-based interfaces have become increasingly popular, as they offer a natural and intuitive way for user to interact with digital objects. In this paper, we propose a hand gesture-based virtual calculator for the metaverse, built using Python programming language.

### Hand gesture-based virtual calculator:

The virtual calculator we propose is built using a combination of hand tracking and gesture recognition. The

system user a depth camera to track the user's hand movements and recognize hand gestures. The user can interact with the virtual calculator by performing a range of hand gestures, such as tapping, swiping, and pinching

The system offers a user-friendly interface, with a large virtual keypad and a responsive calculator output. The virtual keyboard display the standard set of calculator buttons, including digits, mathematical operators, and special functions keys. The user can select a button by pointing at it with their hand and performing a tap gesture. The calculator output is displayed on a virtual screen, and the user can clear the screen by performing a swipe gesture.

### Gesture recognition:

The gesture recognition system we use is based on a machine learning algorithm. The algorithm is trained to recognize a range of hand gestures, including tapping, swiping, pinching, and scrolling. The training data consists of a large data set of hand gesture recorded from different users in different environments. The algorithm is trained using a deep learning frame

## II. LITERATURE SURVEY

Hand gesture-based interfaces have become an increasingly popular mode of interaction in virtual reality (VR) environments. Many researchers have explored the use of hand gestures in VR for a range of applications, including gaming, education, and medical training. In this literature survey, we will review some of the existing work on hand gesture-based interfaces in VR and related fields.

[1] Hand gesture recognition in VR: A review (2018) This review paper provides a comprehensive overview of hand gesture recognition techniques in VR. The paper covers various approaches to hand gesture recognition, including template matching, machine learning, and neural networks.

The authors also discuss the challenges of hand gesture recognition in VR, such as occlusion and lighting conditions.

[2] A Virtual Reality Game for Hand Rehabilitation using Leap Motion and Oculus Rift (2018) This paper presents a hand gesture-based VR game for hand rehabilitation. The system uses the Leap Motion controller to track hand movements and recognize gestures, and the Oculus Rift headset to provide an immersive VR environment. The game encourages patients to perform hand exercises and provides real-time feedback on their performance.

[3] Virtual keyboard for typing in VR using hand gestures (2020) This paper proposes a virtual keyboard for typing in VR using hand gestures. The system uses a combination of hand tracking and gesture recognition to detect the user's hand movements and translate them into keystrokes. The authors compare the performance of their system with a traditional keyboard and show that their system is faster and more accurate.

[4] Hand gesture recognition for human-computer interaction: A review (2021) This review paper provides an overview of hand gesture recognition techniques for human-computer interaction (HCI). The paper covers various applications of hand gesture recognition, including gaming, education, and healthcare. The authors also discuss the challenges of hand gesture recognition in HCI, such as hand pose estimation and variability between users.

[5] A Hand Gesture-Based Human-Machine Interface for Autonomous Driving (2021) This paper proposes a hand gesture-based human-machine interface for autonomous driving. The system uses a depth camera to track the user's hand movements and recognize gestures, and provides feedback on the vehicle's state using a virtual dashboard. The authors evaluate the performance of their system in a driving simulator and show that their system is effective and intuitive.

### III. EXISTING SYSTEM

**AiryCalc:** This is a hand gesture calculator that uses a depth camera to recognize hand gestures. It allows users to perform basic calculations by using gestures such as hand waving or finger pointing.

**Traditional calculator:** Traditional calculator by using the electronic calculator with the keys to perform the arithmetic operations.

**Digital calculator:** Digital calculator application a application with the keys to perform the arithmetic operations.

### IV. PROPOSED SYSTEM

The ultimate objective of developing a hand gesture-based virtual calculator using Python for the metaverse is to provide a more intuitive and immersive user experience in the virtual world. By enabling users to interact with a calculator application using hand gestures, we can eliminate the need for

traditional input devices like a keyboard or mouse, and make the experience more engaging and natural.

In addition to the user experience benefits, this system can also have practical applications in various industries. For example, it can be used in virtual classrooms or training simulations, where users need to perform calculations or analyze data using a calculator. It can also be used in scientific or engineering simulations, where users need to manipulate complex equations or data sets.

Overall, the objective is to provide a more natural and efficient way for users to interact with virtual calculators in the metaverse, ultimately leading to increased productivity and a more enjoyable user experience.

1. **Preprocessing:** Capture the hand gestures and extract relevant features using computer vision libraries like OpenCV.
2. **Gesture Recognition:** Develop a machine learning model using libraries like TensorFlow or Keras to recognize different hand gestures.
3. **Integration with Virtual Environment:** Use game engine libraries like Unity or Unreal Engine to create a virtual environment and integrate the hand gesture recognition model.
4. **Implementation of the Calculator:** Develop a calculator application in Python that can receive input from the hand gesture recognition model and display the output.
5. **User Interface:** Design a user interface that will enable users to interact with the virtual calculator using hand gestures.

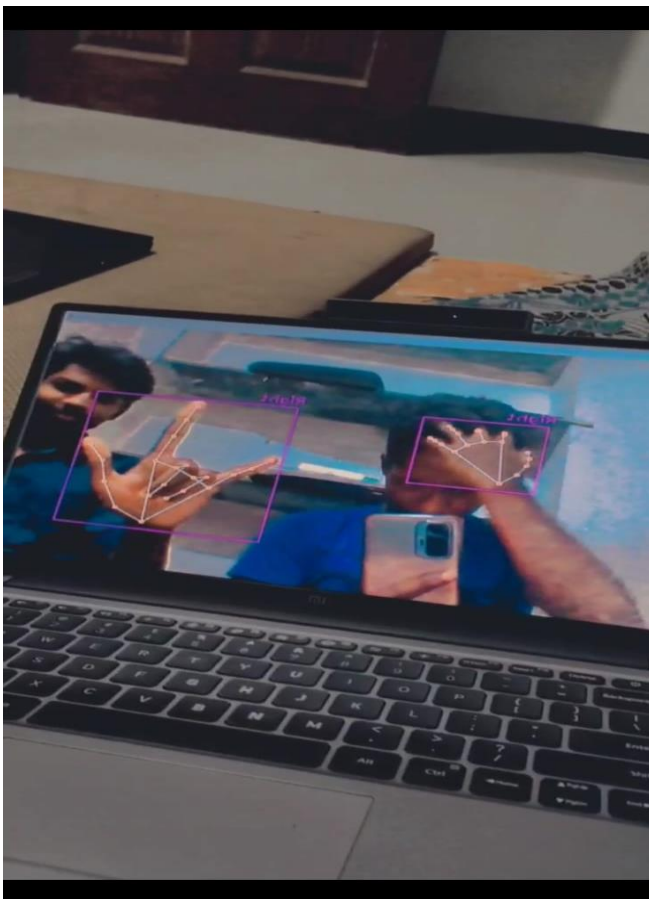
### V. ADVANTAGE OF PROPOSED SYSTEM

There are several advantages of developing a hand gesture-based virtual calculator using Python for the metaverse, including:

1. **Intuitive and Natural Interaction:** The system allows users to interact with a virtual calculator using natural hand gestures, making it more intuitive and easier to use compared to traditional input devices like a keyboard or mouse.
2. **Immersive Experience:** By integrating with virtual environments, the system provides a more immersive user experience, enhancing engagement and enjoyment.

3. **Accessibility:** The system eliminates the need for physical input devices, making it more accessible for users with disabilities or limited mobility.
4. **Efficiency:** Hand gesture-based input can be faster and more efficient than traditional input methods, particularly for complex calculations.
5. **Versatility:** The system can be applied in various industries and applications, including education, engineering, and scientific simulations.
6. **Cost-effective:** The system eliminates the need for specialized hardware, making it a cost-effective solution for virtual calculator applications.

## Output :



## VI. CONCLUSION

Gesture recognition has opened gates for new methods of Human Computer interaction even more powerful than Graphical User interfaces based on keyboards and mouse. Gesture recognition can enable human to interact with machine without any mechanical devices. In this research work I use the concepts of Vision based gesture recognition system in understanding the hand gestures for making a virtual touch screen of numbers. The virtual touch screen is used for computing simple mathematical operation of Addition.

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