

# Hand Gesture Recognition

## Minor Project

Adhyan Dua

00914807723

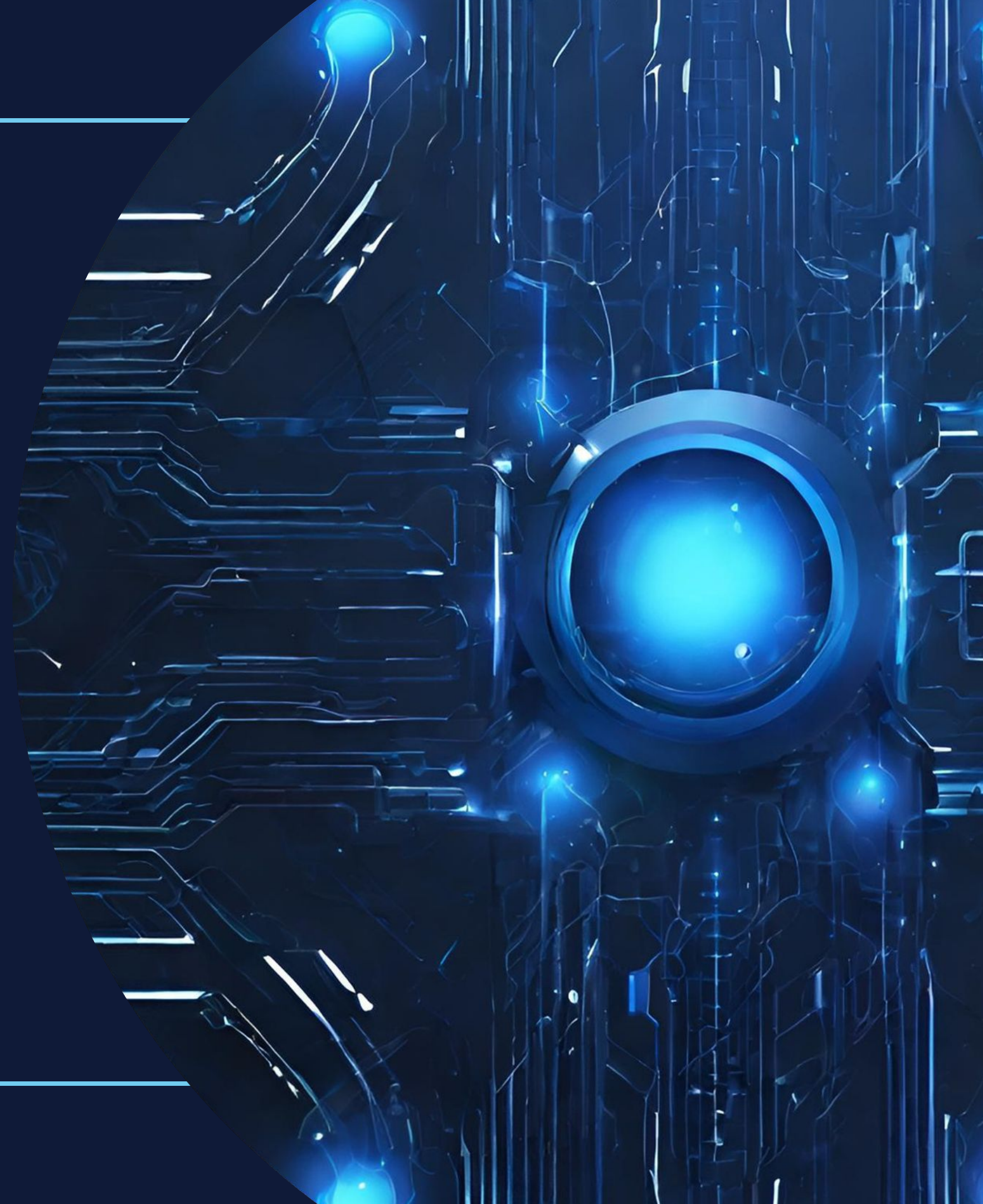
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# Introduction



# INTRODUCTION

What is Hand Gesture Recognition?

- Hand gesture recognition is a computer vision-based technology that interprets human hand movements.
- It enables touchless interaction with devices using predefined gestures.
- Used in gaming, automation, healthcare, and accessibility applications.



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# Research Problem



# RESEARCH PROBLEM

## Challenges in Existing Gesture Recognition Systems

- Low accuracy in complex backgrounds
- Difficulty in handling different hand orientations and sizes
- Limited real-time responsiveness due to computational constraints
- Challenges in applying gestures across different industries





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# Research Questions & Hypothesis

# RESEARCH QUESTIONS & HYPOTHESIS

## Research Questions:

- How can AI and ML improve hand gesture recognition accuracy?
- What are the best techniques for real-time hand tracking?
- How can gesture recognition be used in real-world applications like sign language interpretation and smart home control?
- What are the computational requirements for smooth performance?

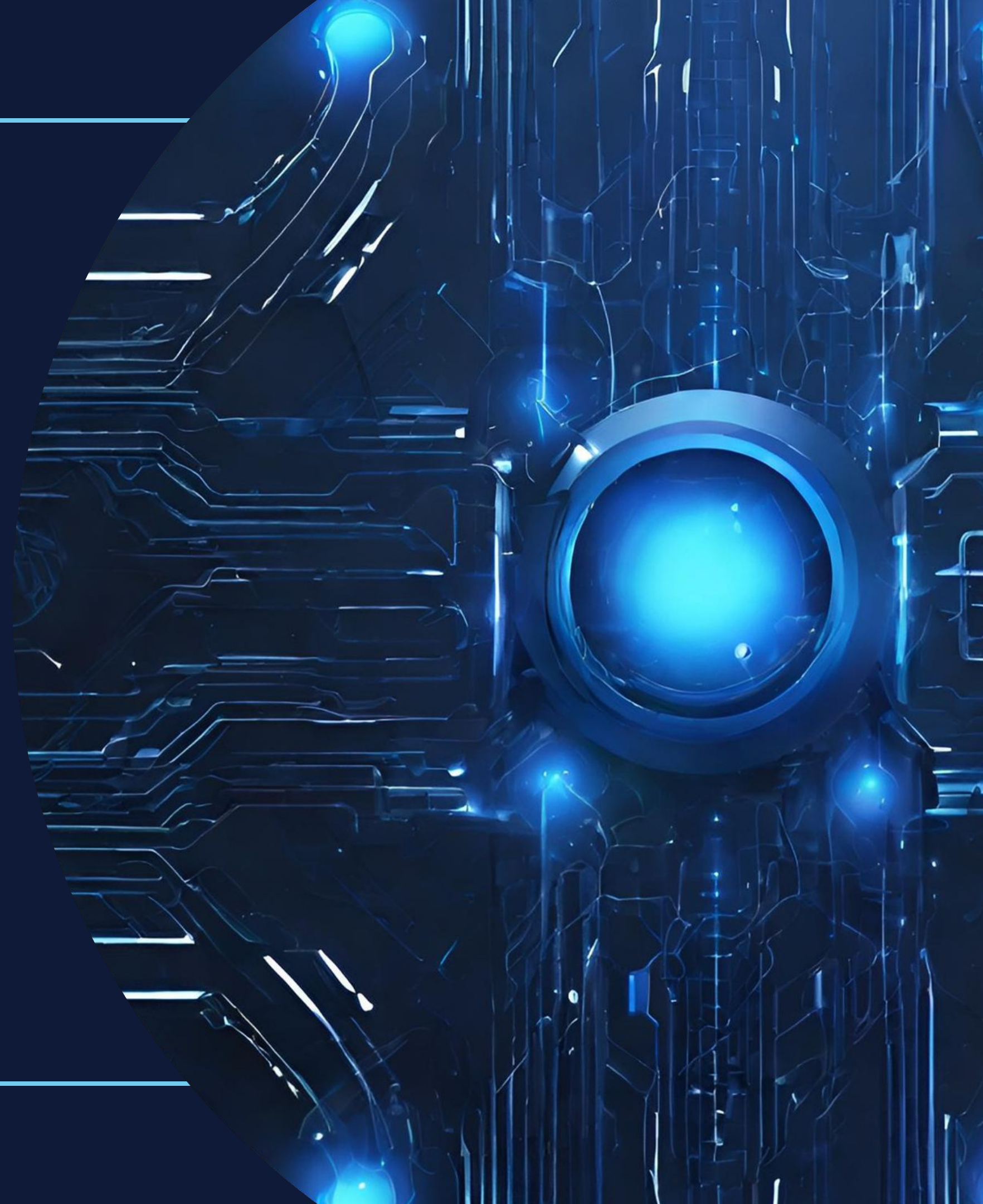
## Hypothesis:

AI and ML models, combined with computer vision techniques, can significantly improve accuracy and efficiency in gesture recognition across various environments.



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# Objectives





# OBJECTIVES

## Goals of the Project:

- Develop a real-time hand gesture recognition system.
- Use AI & ML to classify different hand gestures accurately.
- Improve human-computer interaction (HCI) with touchless commands.
- Enhance accessibility for disabled individuals.
- Ensure the system works in different lighting conditions and backgrounds.





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# Scope of Project



# SCOPE OF PROJECT

Gestures Recognized:

- 👐 Open Palm – Used for stopping or signaling.
- ✊ Fist – Can be used for selecting items.
- 👍 Thumbs Up – Represents approval or confirmation.
- ✌ Victory Sign – Symbolizes success or victory.
- 👌 OK Sign – Represents agreement.
- 🤘 Rock Sign – Used in music and entertainment.

Applications:

- Smart home control – Control lights, music, and devices.
- Gaming & VR – Improve interaction in virtual environments.
- Sign language recognition – Assist hearing-impaired individuals.
- Medical applications – Use touchless commands in sterile environments.



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# Developmental Phases





# DEVELOPMENTAL PHASES

Phase-wise Breakdown:

1. Research & Planning: Study existing methods & define objectives.
2. Data Collection & Preprocessing: Capture and process hand gesture images.
3. Model Development & Training: Train AI/ML models for classification.
4. Implementation & Real-Time Recognition: Deploy the model for practical use.
5. Evaluation & Refinement: Improve system accuracy & performance.



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# Methodology



# METHODOLOGY

How the System Works:

Step 1: Capture hand movements using a webcam.

Step 2: Process the image with OpenCV & MediaPipe.

Step 3: Extract 21 hand landmarks from the image.

Step 4: Feed extracted features into an ML model for classification.

Step 5: Display recognized gestures on the screen.

Algorithms Used:

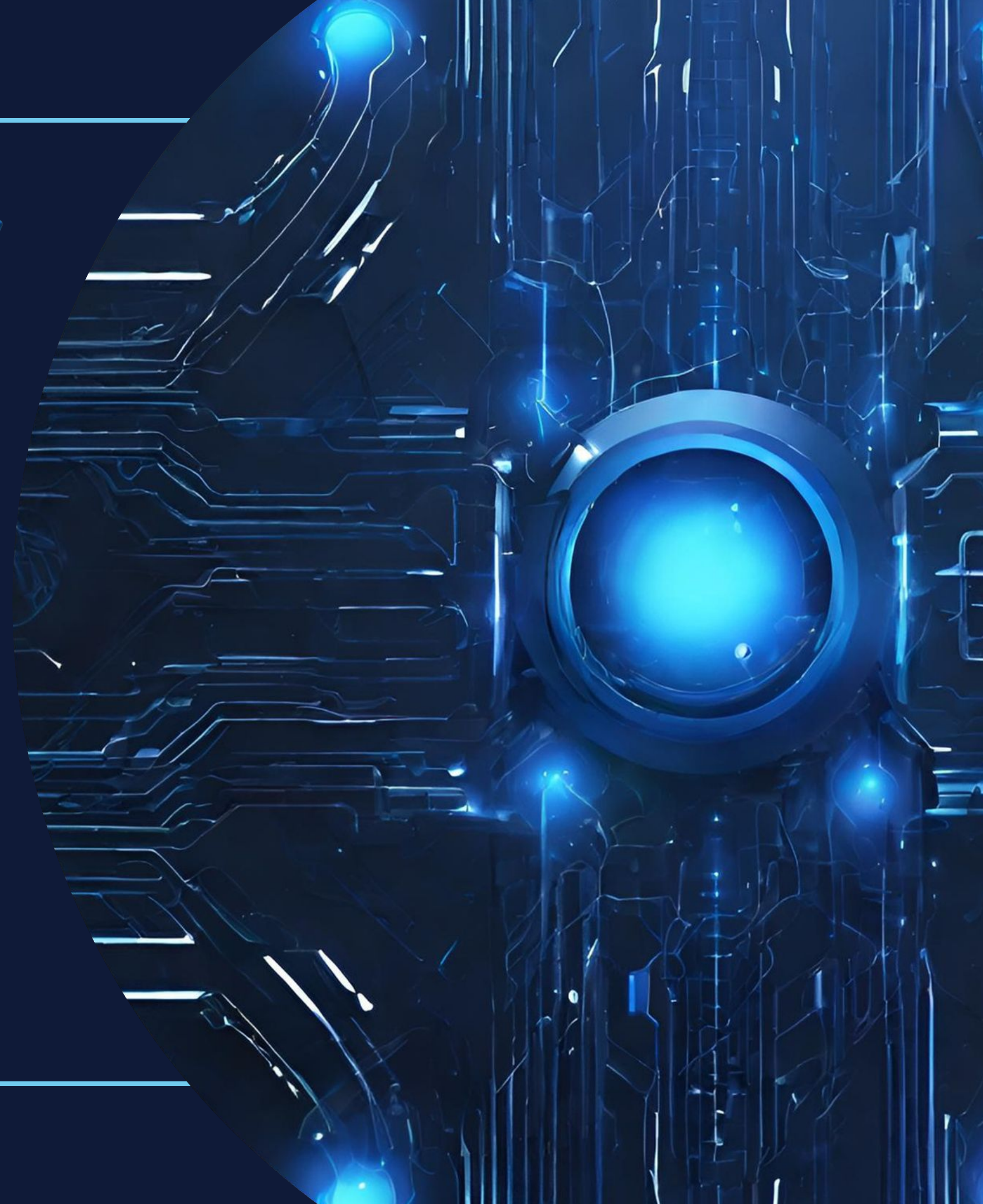
Machine Learning Models: Random Forest, SVM, Neural Networks.

Computer Vision: OpenCV for image processing.

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# Hardware & Software Requirements





# HARDWARE & SOFTWARE REQUIREMENTS

## Hardware:

1. Webcam or depth camera (e.g., Intel RealSense)
2. Computer (preferably with a GPU for faster AI processing)

## Software & Tools:

1. Python – Programming language
2. OpenCV – Image processing library
3. MediaPipe – Hand tracking framework
4. TensorFlow/Keras – Machine learning model training
5. VS Code / Jupyter Notebook – Development environment



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**EXPECTED  
OUTCOME**



# EXPECTED OUTCOME

- The system will successfully detect and classify hand gestures in real-time.
- The model will work with high accuracy in different conditions.

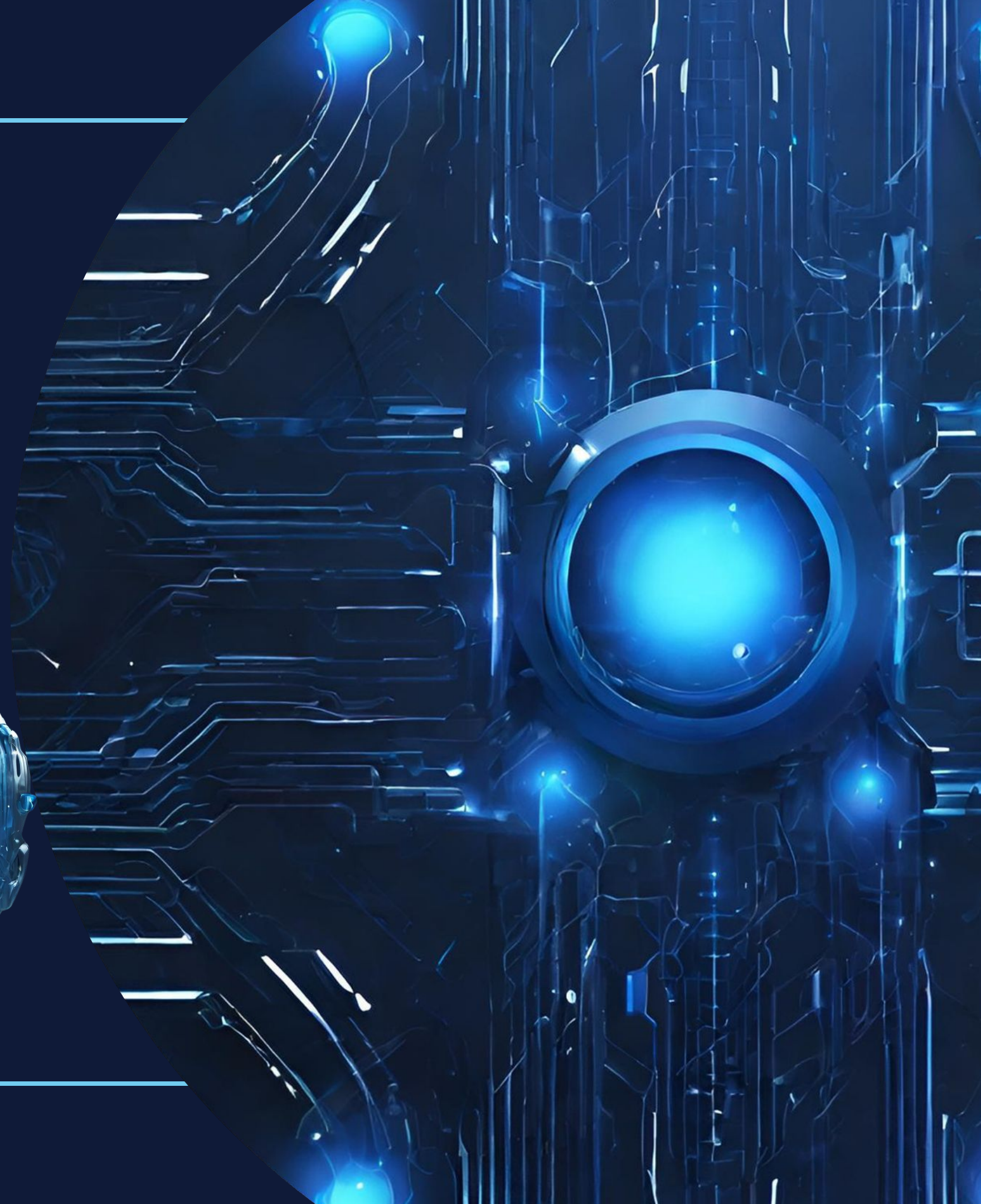
The project will enable gesture-based control for:

- Gaming & Virtual Reality
- Medical Applications (Touchless operations)
- Home Automation
- Assistive Technology (For individuals with disabilities)



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# Conclusion





# CONCLUSION

Current Achievement: Developed a working AI-powered gesture recognition system.

Future Work:

- Expand gesture vocabulary to recognize more complex movements.
- Integrate with voice commands for multimodal interaction.
- Improve accuracy in low-light conditions.
- Optimize performance for mobile and embedded systems.





**Thank You!**

