

DRIVESENSE

GESTURE-CONTROLLED CAR RACING GAME

*"Drive with your **hands**, win with your **skills**"*

NAYAN MISHRA

UNITY DEVELOPER & ML ENGINEER



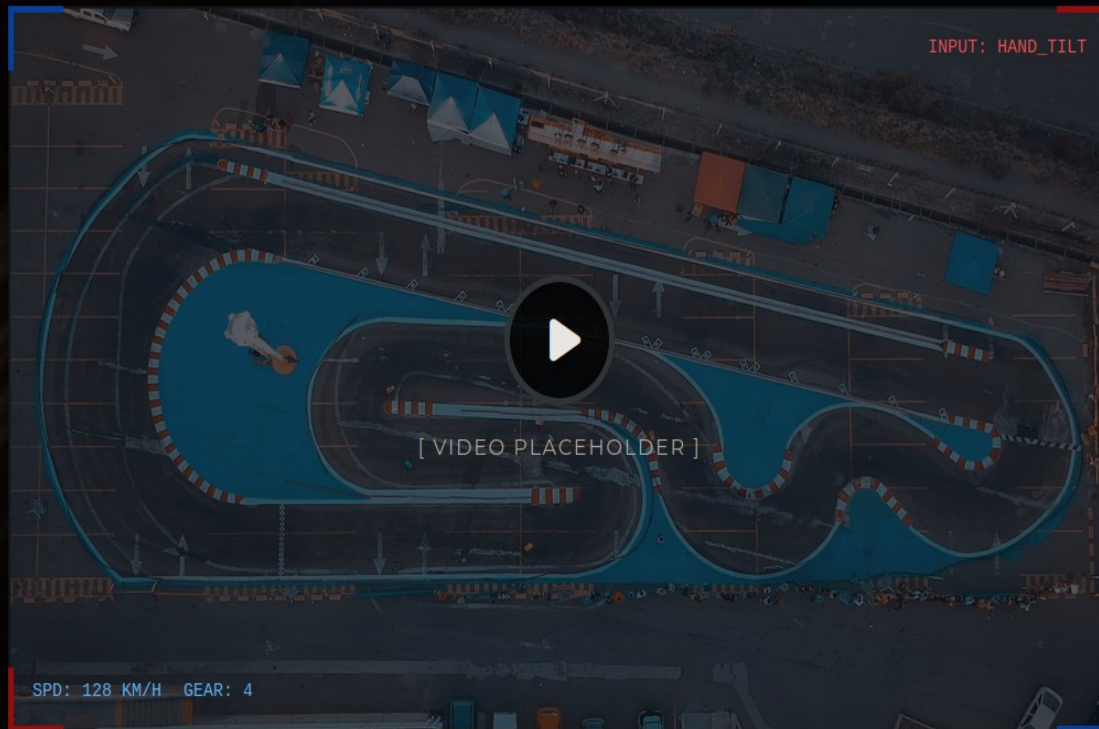
ANUJ SAHU

UNITY DEVELOPER & ML ENGINEER

— DRIVESENSE V1.0

GAMEPLAY DEMO

REC 00:04:21



REAL-TIME CONTROL

CONTROLLER FREE



PROJECT OVERVIEW

INTRODUCTION



TRADITIONAL CONTROLS

Relies on physical hardware like keyboards, gamepads, or steering wheels. Creates a barrier to immersion and restricts natural movement.



DRIVESENSE APPROACH

Utilizes [computer vision](#) to track hand gestures in real-time. Turns your physical movements into direct game inputs for a truly hands-free experience.

IMMERSIVE RACING

NEXT GENERATION CONTROL



VS

PROJECT OBJECTIVE



GESTURE-CONTROLLED GAME

Build a fully functional car racing game that replaces traditional physical controllers with intuitive hand gestures captured via webcam.



SMOOTH CONTROL

Achieve fluid steering and acceleration mechanics by implementing advanced smoothing algorithms to handle raw gesture data.



REAL-TIME RESPONSIVENESS

Ensure low-latency processing where computer vision detection and game physics update instantly for a seamless arcade experience.

ZERO LATENCY



HOW DRIVESENSE WORKS

● SYSTEM: ONLINE

LATENCY: <15ms

01



CAPTURE

Webcam captures live video feed of the player's hands in **real-time**.

INPUT: 640x480 @ 30FPS

02



INTERPRET

Computer Vision algorithms detect hand landmarks and calculate **gesture vectors**.

PROCESS: OPENCV / MEDIAPIPE

03



CONTROL

Unity Engine translates vectors into car **steering** & **speed** mechanics.

OUTPUT: PHYSICS ENGINE

GESTURE CONTROLS

STEERING

AXIS X



Open Index Finger or Pinky Finger **Left** or **Right** to steer the car. Mimics a virtual steering wheel.

SENSITIVITY: 85%

ACCELERATION

AXIS Y+



Open Your Palm **Forward** to accelerate. Distance determines speed.

THROTTLE: LINEAR

BRAKE / REVERSE

AXIS Y-



Close Your Fist, Two Fingers to apply brakes or reverse.

RESPONSE: INSTANT

AUTO PAUSE

SAFETY



If the hand is **Lost** or exits the camera frame, the speed automatically slows.

● FAILSAFE ACTIVE

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GAMEPLAY MECHANICS

MODE: ARCADE



THIRD-PERSON CHASE CAMERA

Dynamic camera angle that seamlessly follows the car, providing optimal visibility of the track layout and upcoming obstacles for precision driving.



SPEED-BASED SCORING

Risk vs. Reward system where score multipliers increase exponentially with speed. Maintain high velocity without crashing to maximize points.



INCREASING DIFFICULTY

Adaptive challenge system where traffic density and minimum required speed ramp up over time, constantly testing player reflexes.



TECH STACK

SIGNAL: STRONG

01 // BACKEND



PYTHON CORE

The brain of DriveSense. Handles real-time gesture processing and data mapping.

OPENCV



MEDIAPIPE



02 // ENGINE



UNITY 3D

High-fidelity graphics rendering and realistic physics simulation for immersive racing.

C# SCRIPTING



PHYSICS ENGINE



03 // INPUT



HARDWARE

Standard webcam input processed in real-time. No specialized sensors required.

WEBCAM



LOW LATENCY



CV PIPELINE

LIVE FEED

PROCESSING TIME: 12ms



LANDMARK DETECTION

Extracts 21 hand keypoints (x,y,z) using MediaPipe hands model from raw RGB frames.

INPUT: RGB



GESTURE SMOOTHING

Uses time-based smoothing to reduce sudden hand movement noise and improve control accuracy.

FILTER: EMA



VECTOR MAPPING

Translates hand tilt angle to steering value (-1 to 1) and depth to acceleration force.

MAP: LINEAR



LOW-LATENCY CONTROL

Sends finalized control packets to game engine physics update loop instantly.

OUT: PHYSICS



KEY FEATURES

MODE: ACTIVE



REAL-TIME HAND STEERING

Advanced computer vision maps natural hand tilts to precise steering inputs instantly. Drive naturally without touching any physical device.



CONTROLLER-FREE RACING

Complete immersion using only a standard webcam. Eliminate the barrier of expensive steering wheels or gamepads for a true hands-free experience.



AUTO-SLOW SAFETY SYSTEM

Intelligent fail-safe mechanism that automatically Slows the car the moment hands leave the camera frame, ensuring seamless interruptions.



| | |
|--------------|---------|
| INPUT METHOD | LATENCY |
| WEBCAM CV | < 50MS |

⚠️ DEVELOPMENT OBSTACLES

CHALLENGES FACED



MAPPING HAND GESTURES

Finding the correct hand gesture mapping for respective motion controls proved challenging, requiring extensive testing to achieve intuitive and accurate steering responses.



UNITY SCENE SWITCHING

Switching between multiple Unity scenes while maintaining hand tracking state and game continuity created complexity in scene management and data persistence.



STEERING STABILITY

Mapping linear hand coordinates to a radial steering axis resulted in oversteering and loss of control at high speeds.



CRITICAL ISSUES

DEBUGGING IN PROGRESS...

ERR_CODE: 0x4B2
FRAME_DROP_DETECTED

SOLUTIONS IMPLEMENTED



ITERATIVE GESTURE TESTING

Conducted extensive user testing sessions to refine hand gesture mappings, establishing intuitive tilt-based controls that feel natural and responsive for steering.



PERSISTENT DATA MANAGEMENT

Implemented DontDestroyOnLoad and singleton pattern to maintain hand tracking state across scene transitions, ensuring seamless gameplay continuity.



NON-LINEAR STEERING CURVE

Applied exponential smoothing and dead-zone thresholds to radial steering mapping, eliminating oversteering while maintaining precision control at all speeds.



SYSTEM OPTIMIZED

PERFORMANCE: **STABLE**

STATUS: **ONLINE**

CONTROL: **STABLE**

TRACKING: **ACTIVE**

WOW FACTORS

STATUS: OPTIMIZED



DRIVE USING ONLY HANDS

Experience true controller-free freedom. The advanced computer vision system maps subtle hand tilts to precise steering angles in real-time.



REALISTIC STEERING FEEL

Forget binary keyboard inputs. Analog gesture mapping provides granular control over turn radius, mimicking the responsiveness of a real steering wheel.



AI-POWERED RACING CONTROL

Intelligent smoothing algorithms eliminate jitter while preserving responsiveness, creating a seamless bridge between human gesture and digital action.

INPUT METHOD

VISION AI

LATENCY

< 50MS

REAL-WORLD APPLICATIONS



RACING SIMULATORS

Enhanced immersion for cockpit setups using natural hand movements instead of traditional controllers or keyboards.



GESTURE GAMING

Paving the way for controller-free arcade experiences in public entertainment centers and interactive kiosks.



TRAINING & ACCESSIBILITY

Providing accessible driving practice options for users with limited mobility or hardware constraints.

SYSTEM STATUS

TRACKING

V.1.0

FUTURE SCOPE



ADVANCED GESTURES

Implementing two-hand tracking for realistic steering wheel simulation and complex maneuvers like gear shifting.



MULTIPLAYER RACING

Enabling real-time competitive racing modes over local networks to challenge friends and global players.



VR INTEGRATION

Porting the experience to Virtual Reality headsets for the ultimate immersive cockpit feel using gesture interaction.

EXPANSION

DEV STATUS

V.2.0



PROJECT CONCLUSION

THE FINISH LINE

DriveSense merges **Computer Vision** and
Racing Gameplay.

Delivering an immersive, controller-free experience that defines the next generation of accessible gaming.

100%

HANDS-FREE

60 FPS


REAL-TIME


0 HW


NO CONTROLLERS

END OF SIMULATION

THANK YOU
TEAM DRIVESENSE

 Nayan Mishra

 Anuj Sahu

 **ANY QUESTIONS?**