

# Real Time-Color Detection using Computer Vision

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## Project Intro:

This Real-Time Color Detection Web App leverages advanced computer vision techniques to detect and track selected colors from a live webcam feed. Using OpenCV for image processing and TensorFlow/Keras for potential AI enhancements, it highlights detected objects with bounding boxes and displays real-time masks. The interactive Streamlit interface allows users to visualize and monitor performance efficiently. This project demonstrates practical applications of AI, computer vision, and real-time video analysis.

## Real-World Applications

- **Robotics & Automation:** Autonomous robots, industrial sorting, drones for object tracking
- **Augmented & Virtual Reality (AR/VR):** Dynamic AR filters, VR motion tracking with color markers
- **Healthcare & Medical Imaging:** Surgical assistance, patient monitoring, lab automation for stained samples
- **Smart Transportation & Traffic Systems:** Traffic signal detection, autonomous vehicles, vehicle tracking
- **Industrial Quality Control:** Defect detection, packaging verification, color-based product inspection
- **Security & Surveillance:** Intruder detection, crowd analysis, camera-triggered alerts for specific colors
- **Sports & Motion Analysis:** Player tracking, ball/object tracking, automated performance analytics
- **AI-Enhanced Retail & Marketing:** Customer behavior analysis, interactive displays, product recognition
- **Environmental Monitoring:** Pollution detection, agriculture & farming, forestry & wildlife tracking
- **Advanced Human-Computer Interaction (HCI):** Gesture recognition, assistive tech for color-blind users, emotion recognition

## Tools & Libraries Used

- **Python & Core Libraries:** Numpy, Pandas, Pillow, Matplotlib, Seaborn – for numerical computations, data manipulation, and visualization
- **Computer Vision & Image Processing:** OpenCV – real-time video capture, color detection, mask generation, and contour detection
- **Machine Learning & Deep Learning:** TensorFlow & Keras – for advanced AI capabilities, model development, and potential future enhancements
- **Web App & UI:** Streamlit – interactive, real-time interface for selecting colors, displaying video streams, and showing processed masks
- **Data Storage & Serialization:** Pickle, CSV, JSON – efficient storage and retrieval of configurations, masks, and results
- **Version Control & Deployment:** Git & Streamlit Cloud – robust source code management and seamless deployment

## Future Market

- **This single topic of color detection sensors market is projected to grow from USD 1.8 billion in 2025 to USD 3.1 billion by 2035, at a CAGR of 5.6%.**
- The future market for color detection in computer vision is poised for significant growth, driven by its essential role in a wide range of applications like manufacturing, healthcare, agriculture, and retail. As a core component of many vision systems, color detection is becoming more sophisticated through AI and deep learning, leading to more accurate and adaptable systems for quality control, diagnostics, and analysis.