Contact-based methods (like ECG, pulse oximeters, and BP cuffs) are generally more accurate and reliable. So why is there growing interest and research in **remote photoplethysmography (rPPG)** and other **non-contact physiological monitoring methods**?

🔍 1. Convenience and Comfort

- **No physical contact**: rPPG uses regular cameras (webcams, smartphone cameras, etc.) to extract heart rate, SpO2, and even blood pressure by analyzing subtle color changes in the face due to blood flow.
- **Better for continuous monitoring**: Users don't have to wear chest straps, finger clips, or cuffs, making it ideal for passive, long-term monitoring.

🦠 2. Hygiene and Safety

- During events like the **COVID-19 pandemic**, non-contact monitoring became essential in hospitals and public areas to reduce the risk of contamination and disease transmission.
- Useful in **clinical triage** situations, where rapid screening is needed without physically touching the patient.

👥 3. Scalability for Mass Monitoring

- In airports, malls, workplaces, etc., rPPG enables simultaneous monitoring of **many individuals** using just a camera setup.
- Particularly useful for **crowd health analysis** or monitoring in **elderly care centers**.

📱 4. Integration with Consumer Devices

- Cameras are everywhere: smartphones, laptops, smart TVs, etc.
- rPPG can turn everyday devices into **health monitoring tools** without extra hardware.

- Used in apps for fitness, meditation, or stress tracking.

🤖 5. Enabling Remote Healthcare and Telemedicine

- In remote or under-resourced areas, contact sensors may not be available.
- rPPG supports **remote diagnostics**, especially in developing countries or home care scenarios.

🧠 6. AI and Computer Vision Advances

- Machine learning has improved signal extraction from video, helping **close the gap in accuracy** between rPPG and traditional methods.
- Deep learning enables better compensation for motion artifacts, lighting variation, and skin tone diversity.

🚀 7. Innovation Push in Wearables and Smart Environments

- Devices like smart mirrors, beds, or even cars can integrate rPPG to monitor health **ambiently**.
- Potential for **personalized health coaching** based on real-time feedback.

⚠️ Limitations (Why Contact Sensors Still Matter)

- rPPG still struggles with:
    - **Accuracy under motion**
    - **Lighting conditions**
    - **Darker skin tones** (due to low signal-to-noise ratio)
- Not yet a **medical-grade** replacement for critical diagnosis.
- Research continues to **validate and improve reliability**.

✅ In Summary:

The shift to rPPG is not about replacing contact-based methods but **augmenting them** with more flexible, scalable, and user-friendly technologies. It's about expanding health monitoring to places and people where contact-based methods are impractical or unavailable.