



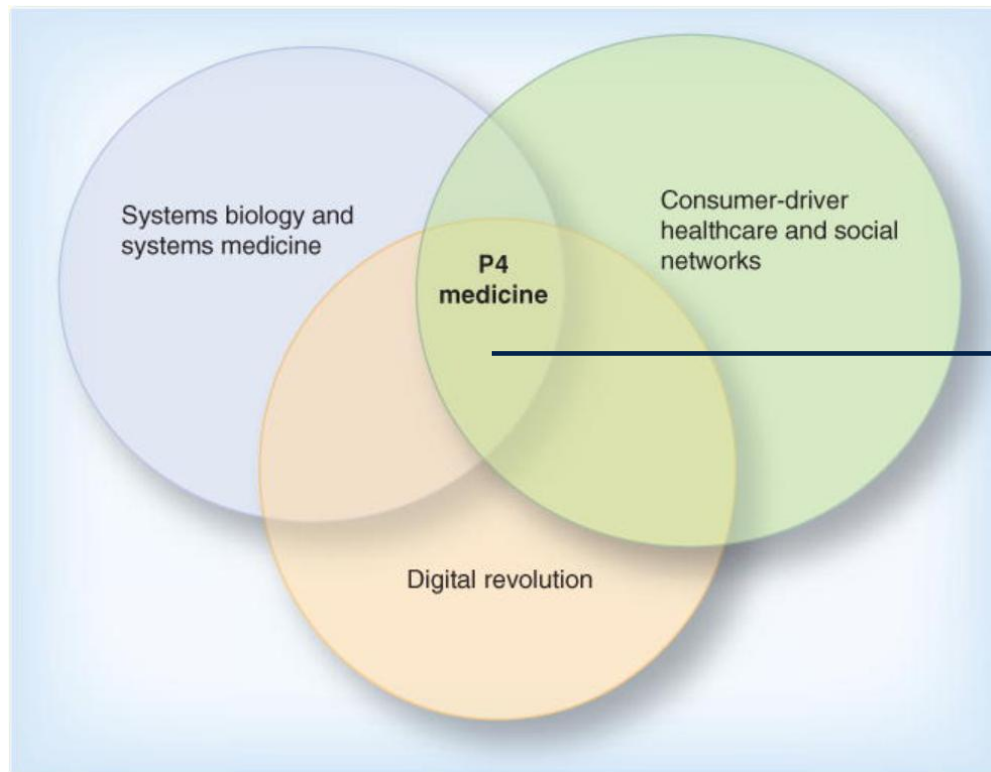
The Intersection of Smart Eyewear and Healthcare

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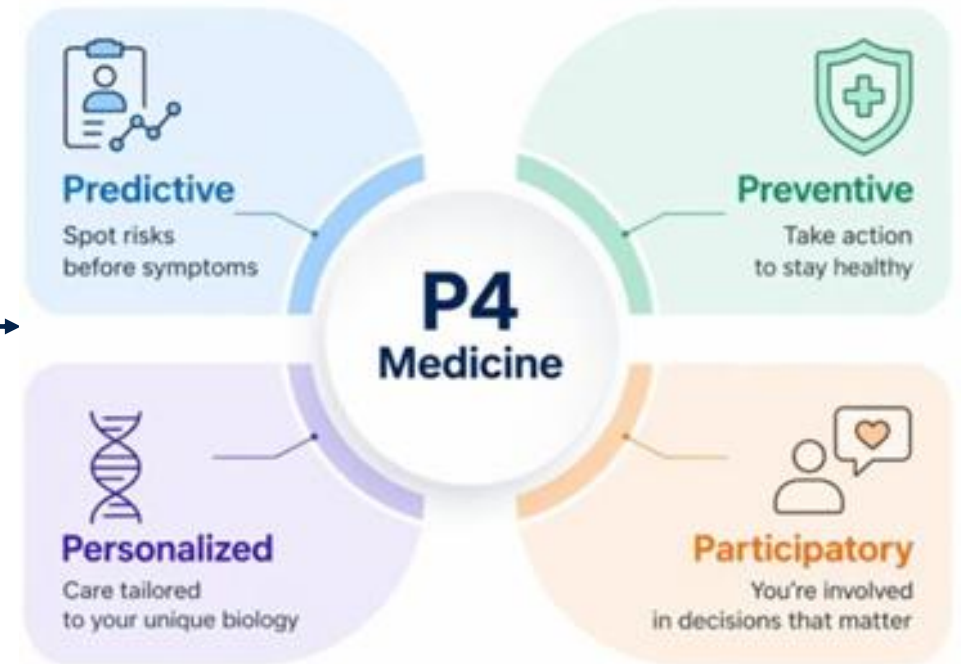
EPIC Technology Meeting: Photonics for AR

Healthcare is Personal

Healthcare & Wellness Markets Increasingly adopting Wearable Devices
Medical & Consumer Markets will Converge around Personalized Patient Care & Well Being



Wearables Devices
are the Enablers



<https://aufaittechnologies.com/blog/p4-medicine-predictive-personalized-care/>

Personalized Medicine (2013) 10(6), 565–576

Evolution of Eyewear: The First Healthcare Wearable

9th–11th C.

Reading Stones

Scholars used polished quartz or glass spheres directly on text to magnify letters.



1727

Rigid Temples

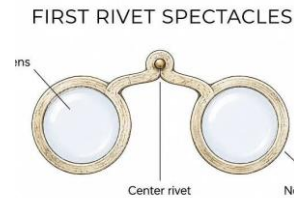
British optician Edward Scarlett invented side-arms that rested over the ears.



1280s–1290s

First Eyeglasses

Artisans in Northern Italy mounted convex lenses in rivet frames for farsightedness.



1784

Bifocal Lenses

Benjamin Franklin invented split lenses combining distance and reading views.



15th Century

Concave Lenses

Developed to correct nearsightedness. Popularity surged after the printing press.

1827 / 1959

Modern Progress

Cylindrical lenses for astigmatism (1827) followed by progressive lenses (1959).

Eyewear Market Drivers

Smart Glasses/Eyewear will be a Healthcare Device

Rising myopia, presbyopia, and digital eye strain burden

Growth in premiumization and fashion-led frame replacement cycles

Smart eyewear convergence with ar, audio, and health functions

Increased employer and insurer-funded vision benefits in mature markets

- Myopia (nearsightedness) has tripled in children since 1990, now affecting 1 in 3 kids globally
- 75% of American adults need vision correction, with 64% wearing prescription glasses
- 83%-89% of Americans over 45 need reading glasses due to presbyopia
- Europe 50%-70% wearing glasses (depending on country)
- Japan leads the world with 73.9% of its population wearing glasses and 55% for Asia-Pacific



Intersection of AR, AI and Healthcare

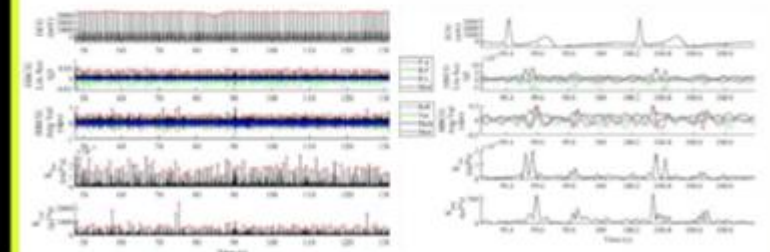
Source: <https://europe.opthalmologytimes.com/view/essilorluxottica-acquires-optegra-clinics-with-support-from-mideuropa>

POLITECNICO MILANO 1863

Objective: to compare different ECG-free methodologies for computing HR from HBCG signals



- FFT
- Template matching on HBCG signals
- **Template matching on kinetic energies**



S Solbiati, S Charkas, F Mozzini, A Lo Mauro, S Bernasconi, A Angelucci, A Aliverti, D Trojaniello, EG Caiani **Comparison of ECG-Free Algorithms for Heart Rate Computation From Head-BCG Signals Obtained With Smart Eyewear**, In Proceedings of the 2024 IEEE International Conference on Metrology for eXtended Reality, Artificial Intelligence and Neural Engineering (MetroXRaine)

SMART GLASSES: HEALTH METRICS & BIOMARKERS

VITAL SIGNS



Heart Rate
128 bpm



HRV
68 ms



SpO₂
98%



Body Temperature
36.7°C



Respiratory Rate
16 bpm

DERIVED BIOMARKERS



Stress Index
Low



Mental Workload
Optimal



Fatigue Score
Level: 1/10



Hydration Level
Good



Migraine Trigger Alert



None

OCULAR & EYE HEALTH



Blink Dynamics
14 blinks/min
Avg. Speed
180ms



Pupil Dilation
4.2mm

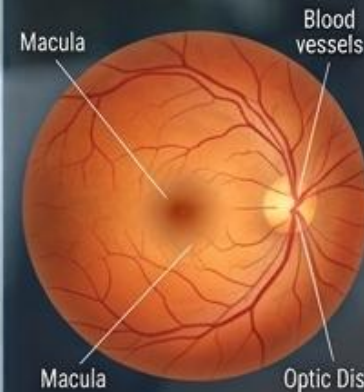


Gaze Tracking



Eye Fatigue
Level: Low

RETINAL IMAGING DIAGNOSTICS



Cardiovascular Disease Risk
(e.g., HTN retinopathy)



Metabolic Disorders
(e.g., Diabetic retinopathy)



Neurological Conditions
(e.g., MS related changes)



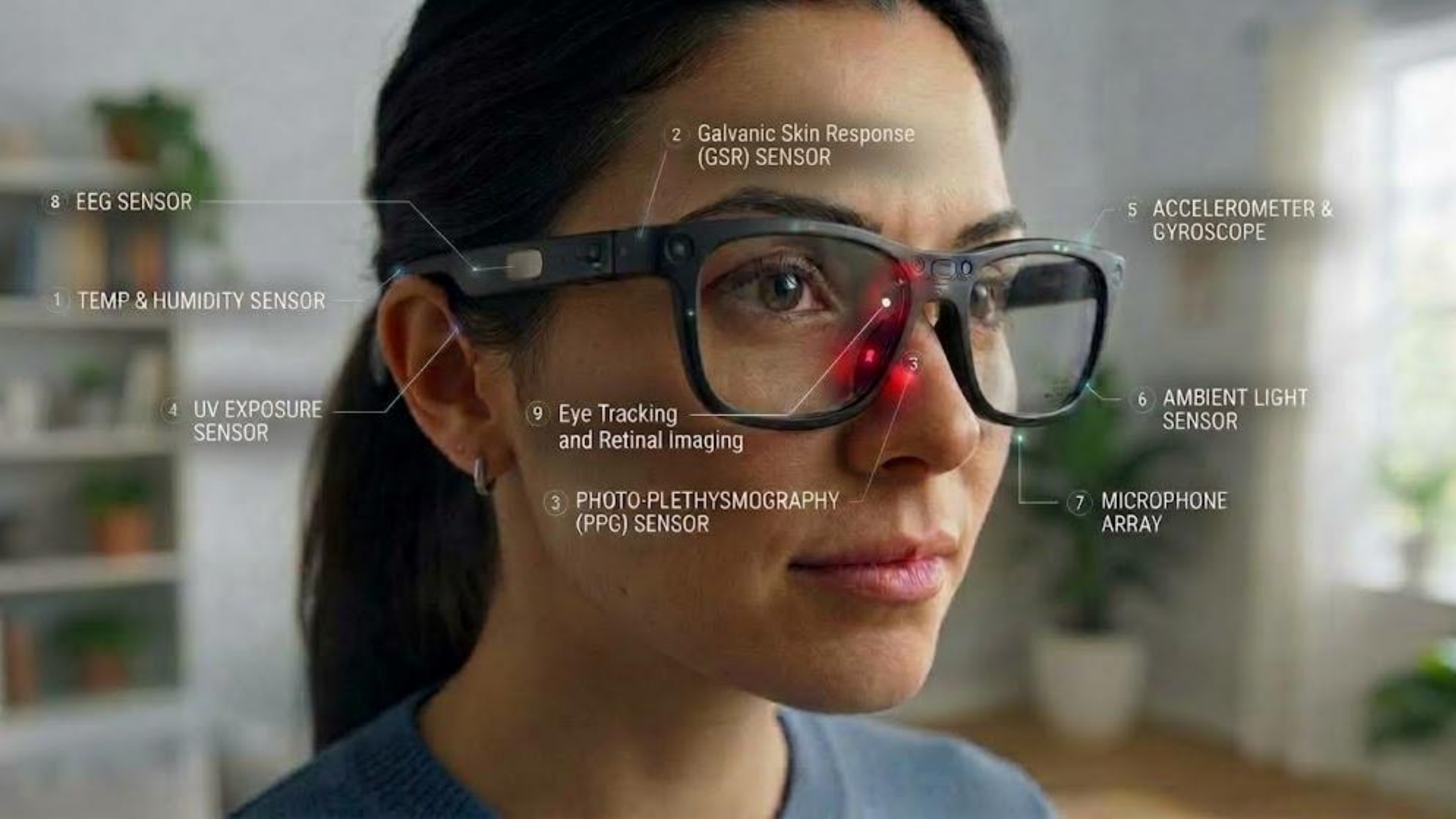
Neurodegenerative Conditions
(e.g., Alzheimer's biomarkers)



Renal Function Assessment
(via microvascular health)



Ocular Diseases
(e.g., Glaucoma, AMD)



8 EEG SENSOR

1 TEMP & HUMIDITY SENSOR

4 UV EXPOSURE
SENSOR

2 Galvanic Skin Response
(GSR) SENSOR

9 Eye Tracking
and Retinal Imaging

3 PHOTO-PLETHYSMOGRAPHY
(PPG) SENSOR

5 ACCELEROMETER &
GYROSCOPE

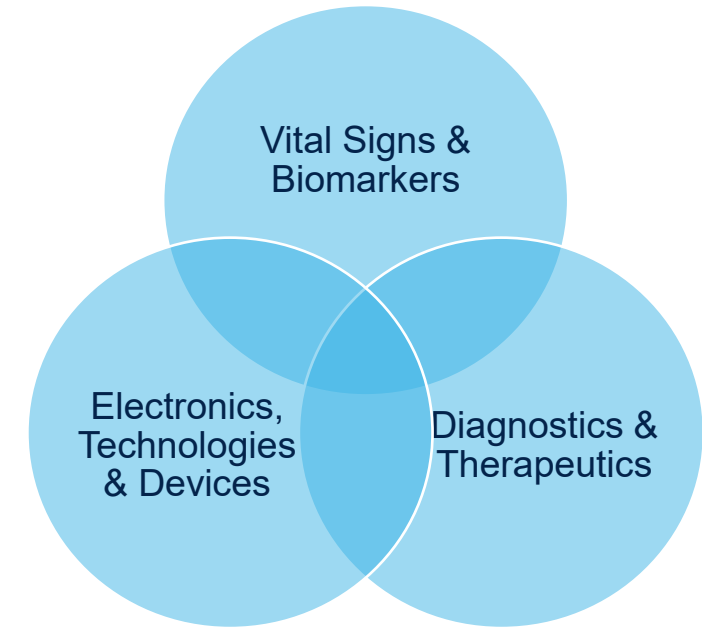
6 AMBIENT LIGHT
SENSOR

7 MICROPHONE
ARRAY

SEMI Smart Medtech Working Group: Bridging the Gap between Electronics & Medicine

Focus on Healthcare Wearables

- Explore Minimal /Non-invasive solutions
- Consider the landscape (research, commercial, regulatory)
- Enable High volume to drive semiconductor companies
- Integrate input from clinicians and healthcare professionals

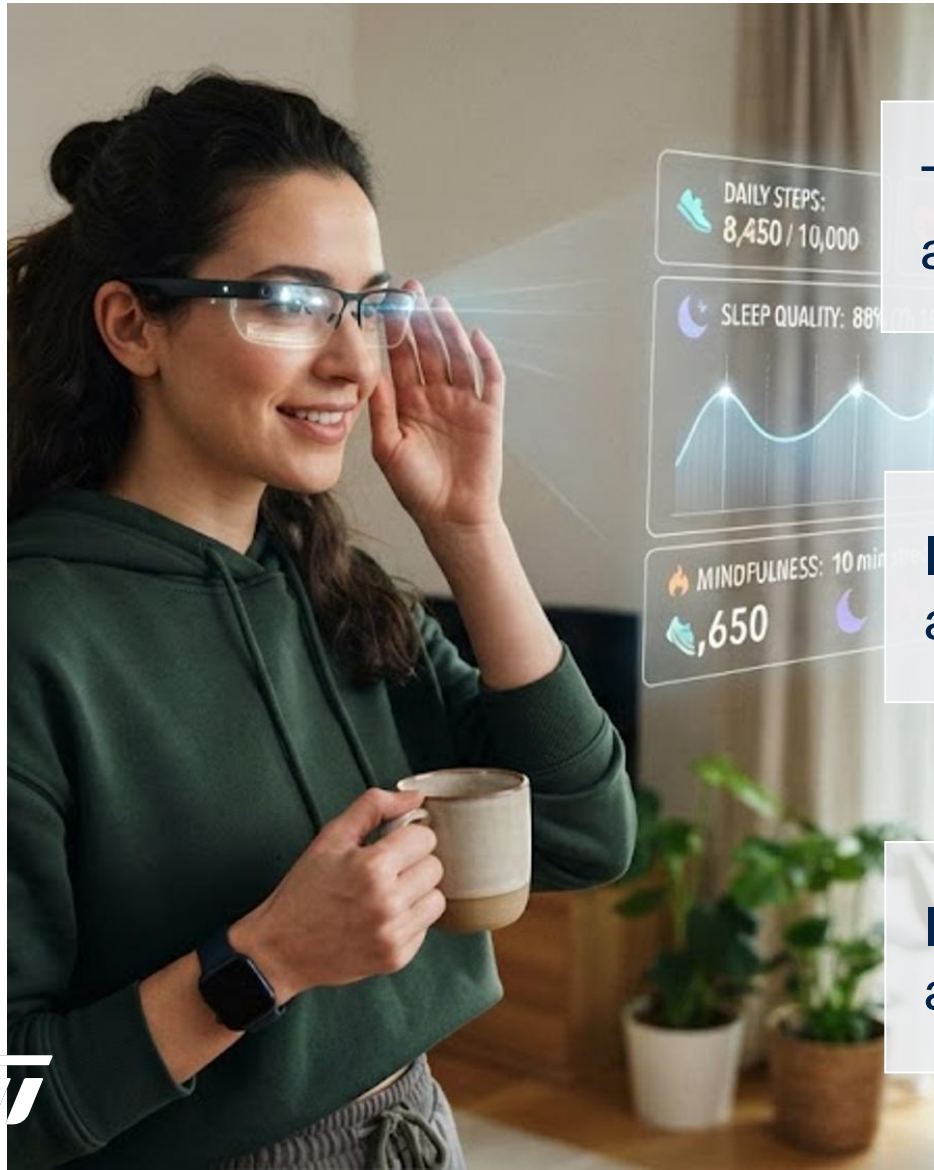


Strategic Outlook: SEMICON 2026

- Biosignal Acquisition
- Clinical Adoption and Regulation
- Edge AI and Cybersecurity

Needed Optics and Photonics Industry Participation

Take-aways



The Smart Glass will increasingly provide greater health and wellness indicators and information

Increasing number of varied sensors and contextually aware AI will be integrated in future eyewear

In the future, multiple body worn devices will be networked and provide personalized healthcare

Our technology starts with You



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