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TECHNOLOGIES FOR FUTURE?
Our Concept of The good Life!

- Knowledge of Nature’s Mysteries
- Admired by friends and strangers
- Friends to play with to whenever we want
- Delicious foods, drink, sensuous touches
- Healthy strong supple bodies
- Nice home in sunny 22C (70F) climate near a body of water in greenery with tall trees

Jasprit singh
The quest for happiness is a central goal of life.

Control of the outside world: technology to manipulate the outside world.
Control of the inside world: self-awareness, mindfulness to control inner desires.

Will the new technology couple the inner and outer world?
How do we deal with Nature’s games? Acceptance or Doing Battle?

To modify Nature we need

- Energy
- Infrastructure
- Feedback (sensors)

Nothing happens without energy
From Local to Global: Holistic Approach

In personal health
In society
In business
In relationships …. Whole picture view is becoming important

Isolated versus balanced
Evolution in Technology: From adding/subtracting to networking

Next generation companies will exploit human needs for personal, social and spiritual growth ...
Technology : Connecting People
Climate Change: Renewable Energy, Technology reducing Energy Needs

Too much heat, too much rain, drought, too cold, dying species, spreading desert, …
Technology: Aging Populations and Increasing Lifespans

- Magenta: over 80 yrs
- Yellow: 60-65
- Black: less than 40

Technology and quality of life: Brain Diseases
Technology: Increasing Quality of Life

How will Sensor technology help?
Self-awareness? Memory Relaxation Techniques?
Sleep at Will?
Pain Relief?
Materials for Smart Technologies

New materials: Carbon based: tubes, graphene,…
Oxides currently limited to passive technologies …

NEED FOR EXPERIMENTAL TECHNIQUES:
X-ray techniques to understand nanostructure;
TEM done with minimal damage to identify atomic positions..
STM techniques for surface atomic arrangements…
Will solid state lighting reach its potential of high power-high efficiency?

An isotropic 1 candela light source emits $4 \pi$ lumens
1 wax candle generates ~13 lumens
A brightly lit conference room ~1000 lumens
Room lit at daylight level ~2000 lumens
At 555 nm:
Conversion of light power: 683 lumens/watt
Average sunlit day: 60,000 lumens/m$^2$ or 60,000 lux
Solar Energy and Conversion

Concentrators?
Low cost mirrors, lenses
Heat extraction/use

Tremendous opportunities: Utility companies; power distribution issues, …
GENERIC HETEROSTRUCTURE FOR MULTI-FUNCTIONAL DEVICES

Traditional “voltage” sensor FET

Pressure sensor FET

Temperature sensor FET

\[ g_m = \frac{\Delta I_D}{\Delta V_G} \]

\[ g_m = \frac{\Delta I_D}{\Delta P_G} \]

\[ g_m = \frac{\Delta I_D}{\Delta T_G} \]

POLAR OXIDES + SEMICONDUCTORS

In the smart-FET devices new functions could be developed
Electromagnetic Spectra: What Semiconductor Technology can Do

• Transistors: Can go up to 500 GHz. Limitations arise from lithography, material properties (carrier transport) and device physics.
• Lasers can provide emission in the range of 25 THz to $10^{15}$ Hz.
• Emission: Window between 0.5 THz to 25 THz. Important window for sensing molecules, thermal imaging.
• Photons with energy beyond 3 eV are important for memory applications, lithography, chemistry, medical diagnostics, …