Michelle Linder February 8th, 2012

Smart Contact Lenses and Glasses with Laser Capabilities
Design Fiction

There continues to be a direct correlation between what devices have been imagined in film and what eventually become realistic technological additions to what is considered socially acceptable devices. Just as in Julian Bleeker's paper on *Design Fiction*[i], hereto, fact and fiction merge to create a realistic and viable device. In this case, fiction has the potential to be reality in the form of giving any individual the power to shoot lasers from their eyes.

Unfortunately, although we do have some of the technology to make lasers shoot from our eyes, we do not know how to do it without damaging the cornea from the heat, nor without blinding the user from the bright light of the laser. However, current day technological advances can allow us to make laser guns, or in this case laser glasses whereby utilizing modified lenses of the glasses to give protection to the eyes from the bright light of the laser.

What makes the Smart Lenses and the Smart Glasses a viable technology are the advances made in Nano-technology and in the development of mini-Linear Accelerator Units.

Currently, the lack of an appropriate energy source to power the glasses is one of the biggest hurdles in making Laser Glasses a reality. Though, there have been some significant developments towards more powerful batteries, recyclable energy sources and solar cells.

The development of new technologies, such as smart watches like the *I'm* watch[ii]*(See Figure 1)*, created a need for more powerful rechargeable batteries in smaller packages; such as the *Li-Po 450 m Ah battery*. A stronger battery source in conjunction with micro-3-Dimensional solar cells[iii] theoretically could handle the power consumption brought on by the Smart Glasses and its laser. Especially if the entire frame of the glasses were to be covered by this material.

Figure 1: The *I'm* watch

3-dimensional solar cells are tower structure less than 100 microns tall, 40 microns by 40 microns square and 50 microns apart *(See Figures 2 & 3)*. These cells are grown from arrays containing millions of vertically aligned carbon nanotubes. The nanotubes primarily serve as the structure of which current-generating photovoltaic p/n coatings are applied. The using of three dimensional structures means that the cells don't have to be aimed directly at the sun to capture sunlight efficiently[iv].

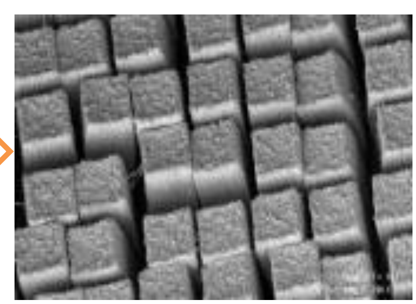


Figure 2: Three dimensional structures used by the three dimensional photovoltaic cells to increase the amount of light captured thereby increasing solar power. The additional light increases the power output of the cells.

Jud Ready, GTRI senior research engineer

Figure 3: Sample of the 3-D solar cells. This picture displays how small the cells are.

Conceptually, if it is possible to make 3-Dimensional solar cells in cubes, why not make them in spheres or domes and increase the number of angles by which the cells can capture light *(See Figure 4)*.

Figure 4:
Conceptual design of 3-D micro-solar cells that could coat frames of glasses

The laser of the Smart Glasses is directed from a mini-circular accelerator unit located inside the frames just outside of the circumference of the lenses *(See Figure 5)*. Energy particles are recycled and recirculated through the accelerator unit until enough power has been built-up[v] *(See example in Figure 6)*.

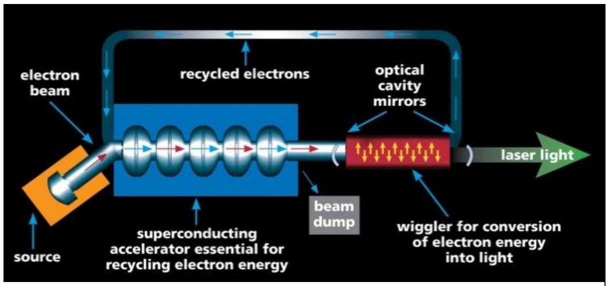


Figure 6:

Diagram of the Jefferson Laboratory FEL. Electrons are released from the source at the lower left, and are accelerated in a superconducting linear accelerator. The electrons then pass into a laser cavity. In the cavity center is a wiggler, a series of magnets that deflect the electrons back and forth. This makes the electrons emit light, which is captured in the cavity, and used to induce new electrons to emit even more light. After exiting the optical cavity the electrons travel around the loop at the top and back into the linear accelerator. Here they give up most of their energy to a new batch of electrons, making the process highly efficient.

At which time the beam is enhanced as it is released through a targeting structure made of photo-thermo-refractive glass designed to survive high-energy laser irradiation without changing its properties or significantly affecting the beam. The glass used in the laser is made of a sodium-zinc-aluminum-silicate glass doped with silver, cerium and fluorine. This glass is unique in that it is transparent, but also photosensitive like film. This allows developers to record holograms and other optical structures in the glass, and then develop them in a furnace. After which the optical characteristics of the glass are tweaked so that it can resist degradation[vi] *(See Figure 7 & 8)*.

Figure 5: Close-up of mini-circular accelerator unit situated inside the frame of the glasses

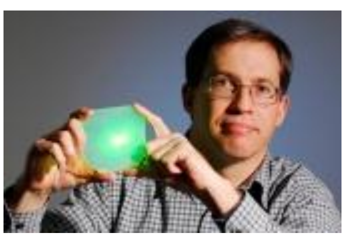


Figure 7:
GTRI senior research scientist David Roberts developed a system to measure a laser's power and spatial energy distribution simultaneously, helping accelerate the development of high-energy laser systems & reduce the time required to make them operational

Figure 8:
With Orlando-based OptiGrate, GTRI senior researcher David Roberts designed & fabricated a target board that can survive high-energy laser irradiation without changing its properties or significantly affecting the beam.

The lenses and frames are made of Graphene which renders the Smart Glasses scratch proof and bullet proof [vii]. Graphene is not only highly conductive, but it has the same atomic structure as diamonds. When shuffled and layered with other strong elements and more graphene[viii], eventually we come up with a transparent material that is as strong as diamonds, making the Laser Glasses at least bullet resistant and at most, bullet proof. In addition, because of the conductive nature and transparency of graphene, it can be used to create a computer screen interface on the lenses of the glasses.

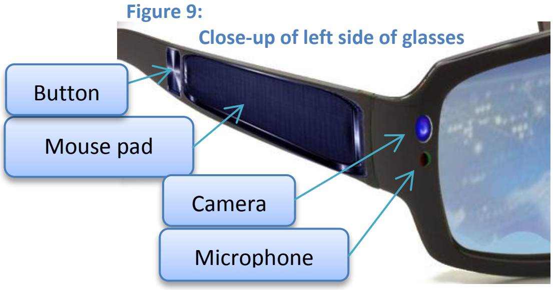
Nano-tech circuitry allows room inside the Smart Glasses' frame for computer, video and photographic hardware. This is in addition to both a parabolic directional and laser micro-phone[ix][1].

The lenses of the smart glasses are the user interface menu which appears as a luminous transparent computer screen. In conjunction with the Smart Contact Lenses, the screen creates a 3-dimensional virtual reality.

Selecting icons and navigation through different menu options is conducted by way of three different routes that are at the user's discretion:

1. Eye tracking: Through eye tracking software and Nano-circuitry built into the contact lenses, selection becomes a matter of look and blink.
2. The mouse pad: Smart glasses come with a mouse pad and button built into the side of the frame. Selection is a matter of moving the users finger around the mouse pad until the interface arrow is over an icon or command on user's screen, and the button is pressed *(See Figure 9)*.
3. Voice commanded selections where user merely says specific commands and verbalizes choices. Software for voice recognition is already on the market through the company, Nuance.

Figure 9:
Close-up of left side of glasses



In order to avoid accidental discharges of laser weapon, user must operate mouse to select the targeting system, at which time, firing only requires user to look at target and press the button on the side of the frame of the Smart Glasses or use the voice command option and say "fire" (operator should have the option to change specified command words through the menu interface).

The Smart Contact Lenses were designed from the improvement of existing systems. These include, but are not limited to research being conducted at the US Department of Defense (DoD) and Microsoft. Specifically, the DoD is currently testing a pair of iOptik contact lenses to determine if the advanced optics are capable of providing greater situational awareness for soldiers in the field[x], and Microsoft is already developing a contact lense that can monitor blood sugar and other health informatics in addition to ubiquitous computing utilized as a directional interface.[xi] This research lead me to the idea of Smart Contact Lenses which could allow the user to see everything through various seeing options from telescopic to microscopic.[xii]

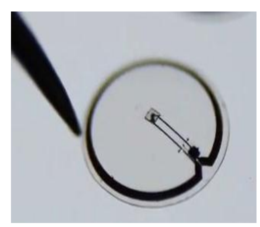


Figure 5:
Microsoft's smart contact

The Smart glasses would need to have the hard drive space and random access memory of at least a high-end laptop. Therefore I came up with the following specs: 450 gigabytes of RAM and 650 gigabytes of Hard Drive space. The glasses would require enough RAM space to handle all the programs that would need to be installed; Programs such as some of the advanced

---

[1] Professor John Cressler of GTRI has successfully nanoengineered 200 GHz silicon-germanium integrated circuit wafers. I believe that once scientists work out the bugs with graphene, they won't need silicon and will be able to make these and other types of circuits much smaller. This could be very feasable due to the conductive nature of graphene and the fact that researchers have successfully made sheets of this material one atom thick. Imagine a circuit that measures in area 200 atoms or less.

targeting systems that have been, and continue to be, developed by the Air force. As well as facial recognition software that wouldn't have to be limited to finding criminals in a crowd, but would also be great for people who are terrible with names and faces. Imagine if you could use facial recognition software to store the names, faces and pertinent information on all the people you meet. Imagine having access to all that information on a screen in front of your eyes in the time it takes for someone to walk up to you; previous conversation topics, names of their wife and kids, etc. You would never again have to worry about accidentally running into that guy you owe money to.

Also, since we have blue tooth technology, I thought it would be easier for the user to not have to take off their glasses and plug them into a computer to transfer data. Therefore data would be transferable through Bluetooth technology and thereby, never leaving the user without access to all of the Laser Glasses features and capabilities.

There are a few issues that prevent making Laser Glasses a reality. As mentioned earlier in this paper, one of the problems is the energy source. In spite of the advanced targeting material, 3-D solar cells, accessible tiny batteries and recycling accelerator units, lasers eat up quite a bit of electricity, and the stronger the laser the more power it requires. In addition, based on research that is available to the public, scientists are only beginning to create Nano-circuitry so it might be a while before we can fit all the components we would need inside such a small area.

Then there's the problem with the magnetic field. An accelerator unit works by moving particles faster and faster along a tube. What gets the particles to move are electrified magnetic coils. So in order to cut something or shoot someone with your laser glasses you are in effect creating a magnetic field less than an inch from your brain[xiii]. There have already been studies regarding the effects of magnetic fields on humans. When considering those who have developed brain tumors caused by the light magnetic field of their cell phone use, one can only imagine the short and/or long-term effects from exposure to the magnetic fields caused by a mini-circular accelerator unit.

Just as David Kirby predicted in *The future is now*[xiv], the public is both ready and use to the idea of convenient deadly lasers because people have been reading and watching movies about this type of technology since the B-Sci-Fi films of the 1950's. Just as narrative structure continues to contextualize technologies within the social sphere, so too do scientists contextualize invention from what has already been imagined, only with the goal to improve upon it.

The Laser Glasses and Smart Contact Lenses have a great potential as a usable device whether the operator is a soldier, clandestine operative or a member of the NRA who's willing to give up their firearm for a viable alternative.

Features of the Smart Contact Lenses

1. Telescopic to microscopic vision
2. Bluetooth Connection (to software in sunglasses)
3. 3-Dimensional visual interaction with facial recognition software
4. Eye tracking software for menu selection, targeting, and laser-guided missile directing
5. Corrective Lenses to any vision type except Astigmatism

Features of the Smart Glasses

1. Lense color manipulation interface
2. Laser beam with metal cutting capabilities
3. 2 Mini-Circular Accelerator Units
4. Mouse pad and button
5. Control menu interface for Smart Lenses
6. 3-Demensional viewing of User Interface
7. Eye-tracking interface with Smart Lenses
8. Targeting interface
9. Ubiquitous computing for visual directions with or without blueprints of area.
10. Video and photographic lense with zoom in and out capabilities
11. Bluetooth memory transfer capabilities
12. Rechargeable battery
13. 3-Demenstion Solar Cells to increase battery life
14. Nano-technological circuitry and memory chips
15. Bullet proof

Additions I would have liked to have added

1. Lie and deception detection, by monitoring heart rate, sweating and micro-facial expressions
2. Night-vision
3. Eye-color changer built into contact lenses
4. Heat censoring and infrared vision.
5. Cell phone
6. Long distance laser targeting to assist in surgical bombing campaigns
7. Radiation testing and Geiger counter capabilities with sunglass interface readouts in RAD measurements
8. Air filtration and clean air delivery system for toxic environment protection

9. Toxic chemicals testing capabilities with sunglasses displaying read-outs in ppm measurements. (This capability is dependent on whether or not technology can develop a Mini-Mass Spectrometer)

---

[i] Near Future Laboratory, *Design Fiction; A short essay on design, science, fact and fiction,* March 2009, Julian Bleecker

[ii]The *I'm* watch can be found at http://www.imsmart.com/

[iii] Georgia Tech Research Institute, *Nano-Manhattan: 3-D Solar Cell that Uses "Towers" to Boost Efficiency Wins International Patents,* Jud Ready Senior research engineer

[iv] Georgia Tech Research Institute, *Nano-Manhattan: 3-D Solar Cell that Uses "Towers" to Boost Efficiency Wins International Patents,* Jud Ready Senior research engineer

[v] The Division of Physics of Beams of the American Physics Society (APS), *Accelerators and Beams; Tools of Discovery and Innovation*, Edited by Ernest Malamud, University of Nevada

[vi] GTRI, *Directed Energy Weapons: New System Developed to Test and Evaluate High-Energy Laser Weapons,* David Roberts Senior research scientist

[vii] MIT Media Relations, http://web.mit.edu/press/2011/graphene-center
Wikipedia, http://en.wikipedia.org/wiki/Graphene

[viii] Nobelprize.org, *2010 Nobel Lecture Presentation for Physics*, Andre Geim, December 8th, 2010
http://www.nobelprize.org/mediaplayer/?id=1417&view=34

[ix] GTRI, *Smaller is Better: Nanoengineered Silicon-Germanium Microships May Herald new Applications from Radar to Space Exploration,* John Cressler.

[x] TGDaily, *Pentagon tests "smart" contact lenses*, Posted April 18th, 2012, Shane McGlaun,
http://www.tgdaily.com/hardware-brief/62728-pentagon-tests-smart-contact-lenses#MMqZ6Zb60Y1VHppW.99

[xi] Ubergizmo *Microsoft develops smart contact lenses,* Posted January 5, 2012, George Wong
http://www.ubergizmo.com/2012/01/microsoft-develops-smart-contact-lenses/

[xii] PubMed*, Use of a contact lens telescopic system in low vision patients,* December 24, 2001, J Lavinsky, G. Tomasetto, E. Soares, http://www.ncbi.nlm.nih.gov/pubmed/11775040

SPIE Digital Library, *Telescopic vision contact lens,* Eric J. Tremblay, R. Dirk Beer, Ashkan Arianpour, Joseph E. Ford, *Proc. SPIE* 7885, Ophthalmic Technologies XXI, 788510 (); doi:10.1117/12.878795,
http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=732435

http://patentscope.wipo.int/search/en/detail.jsf?docId=WO2012051223&recNum=6&docAn=US2011055850&queryString=ALLNAMES:(ford)&maxRec=11273

[xiii] National Cancer Institute, *Cell Phones and Cancer Risk*,
http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones
Magnetic Field Exposure and Cancer: Questions and Answers
http://www.cancer.gov/cancertopics/factsheet/Risk/magnetic-fields

[xiv] Social Studies of Science, *The Future in Now: Diegetic Prototypes and the Role of Popular Films in Generating Real-world Technological Development,* David Kirby, September 30th, 2009
http://sss.sagepub.com/