

1 Shock-absorber

Power from bumps in the road

A TEAM OF MIT UNDERGRADUATE STUDENTS has invented a shock absorber that generates electricity from small bumps in the road, while at the same time it smoothes the ride more effectively than conventional shocks. Hybrid vehicles use some of the wasted energy during braking, so the team looked for additional places in a vehicle where energy is wasted. The suspension system was identified as a good candidate. After outfitting different cars' suspension systems with sensors and laptop computers that monitor the amount of wasted energy, the students determined that especially for heavy vehicles it will make a lot of sense to develop shock absorbers that can generate power and improve the efficiency of their operation. Senior Shakeel Avadhany and his teammates developed a prototype of a system in which shock absorbers use a hydraulic system that forces fluid through a turbine attached to a generator. The system is controlled by an active electronic system that optimizes the damping, providing a smoother ride than conventional shocks while generating electricity to recharge the

batteries or operate electrical equipment. They say that using such regenerative shock absorbers can produce up to a ten percent improvement in overall vehicle fuel efficiency.

To commercialize their invention, the members of the team have established Levant Power Corp. and named their device GenShock. The tests of the prototype on a Humvee have demonstrated that each regenerative shock absorber can produce between 500 and 1000 W of power when the vehicle was driven on a standard highway. This power could be used instead of alternator power, thus improving fuel-efficiency by 3-5% and helping to drive electric equipment used on the vehicle.

Since GenShock is a fully-active system, it can dynamically adjust damping characteristics instantaneously. Damping can be stiffened or relaxed depending on the weight and/or sensitivity of the load. Simple applications allow the suspension to change damping depending on the weight of the load. Advanced algorithms allow for real-time adjustments to create a smooth ride with better handling characteristics than conventional shock absorbers. Considering the use of GenShock for military and trucking applications, Levant Power Corp. has developed the components of the system understanding that they have to be able to withstand the harshest environments while maintaining a high level of reliability. The system is designed for zero-downtime. In the unlikely case that the control system fails, the system reverts to perform like a standard (non-active) shock absorber. ■



Happy with the performance results!



A GenShock prototype in a Humvee vehicle

Additional information is available at <http://web.mit.edu/>

Ryan Bavetta, left, Zack Anderson, center; and Shakeel Avadhany, top; three of the designers of the GenShock shock absorber, which can generate electricity from bumps in the road.

2 'Magic' Lights – expected to slash household electricity use

A new way of making LEDs could see household lighting bills reduced by up to 75% in five years time, thanks to research at Cambridge University, UK. The new LEDs use Gallium Nitride (GaN), a man-made semiconductor that emits a brilliant bright light but uses very little electricity. Until now however, high production costs have made GaN lighting too expensive for widespread use in homes and offices. The Cambridge University Centre for Gallium Nitride, with funding from the Engineering and Physical Sciences Research Council (EPSRC), has developed a

new way of making GaN which could produce LEDs for a tenth of the current prices. The new technique grows GaN on silicon wafers. This achieves a 50 percent improvement in costs and efficiency in comparison to the previous approaches to grow GaN in labs on expensive sapphire wafers, used since the 1990s. Based on current results, GaN LED lights in every home and office could cut the proportion of UK electricity used for lights from 20 percent to 5 percent. This is a reduction equivalent to the output of eight power

stations. A GaN LED can burn for 100,000 hours and therefore, on average, only needs replacing after 60 years. Further, unlike currently available energy-saving bulbs, GaN LEDs do not contain mercury, which eliminates the environmental problems posed by their disposal. GaN LEDs also have the advantages of being dimmable and turning ON instantly.

Professor Colin Humphreys, lead scientist on the project said: *"This could well be the holy grail in terms of providing our lighting needs for the future. We are very close to achieving highly efficient, low cost white LEDs that can take the place of both traditional and currently available low-energy light bulbs. That won't just be good news for the environment, it will also benefit consumers by cutting their electricity bills."* GaN LEDs, used to illuminate landmarks like Buckingham Palace and

Text and pictures : **Courtesy of University of Cambridge, UK**



Light Emitting Diodes LEDs

the Clifton Suspension Bridge, are also appearing in camera flashes, mobile phones, torches, bicycle lights and interior bus, train and plane lighting. Parallel research is also being carried out into how GaN lights could mimic sunlight to help 3m people in the UK with Seasonal Affective Disorder (SAD). Ultraviolet rays made from GaN lighting could also aid water purification and disease control in developing countries, identify the spread of cancer tumours and help fight hospital 'super bugs'.



You can start researching from the university's web site:

<http://www.admin.cam.ac.uk/news/dp/2009012803>

3 ZigBee communications

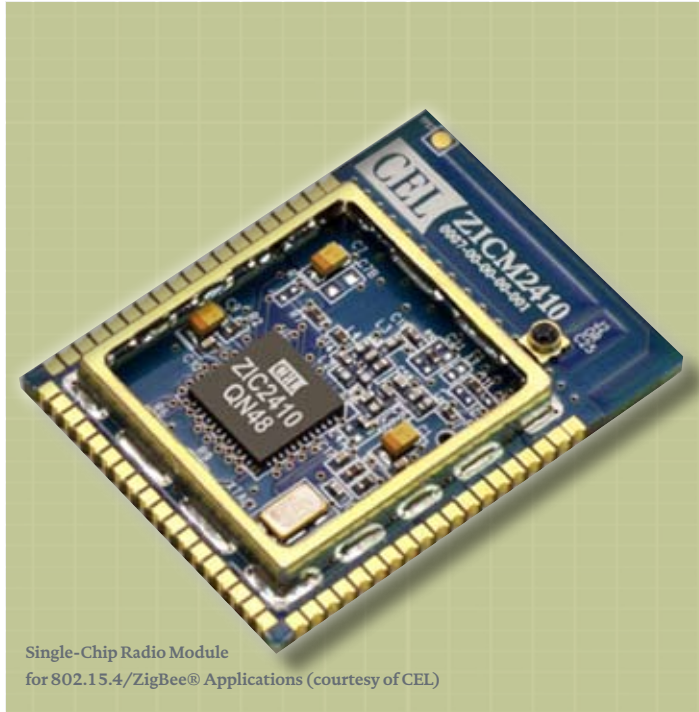
THE INCREASING INTEREST AROUND THE WORLD in development of “smart grids” requires the acceptance of communications standards that are designed specifically for low power, low data rate networks. The protocols need to be secure, robust, and resistant to outside RF interference in order to be used for industrial and home automation networks.

IEEE 802.15.4 was designed to address the need for a low-cost, low-power wireless standard optimized for monitoring and control applications. While similar to other low power wireless standards, features such as fast power-on latency and mesh networking help differentiate it from the field of other existing IEEE technologies.

IEEE 802.15.4 has become a solid foundation for low rate wireless solutions. Some of its benefits are:

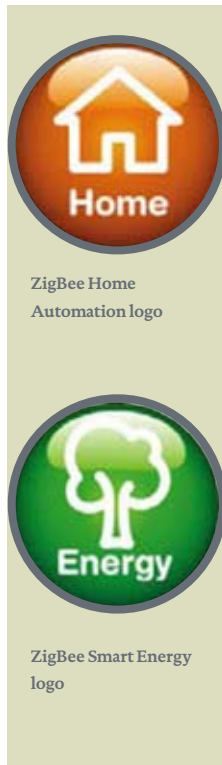
- 2.4 GHz, 16 channels, 250 kbps data rate
- DSSS energy spreading scheme
- CSMA-CA
- AES 128 encryption and authentication
- Simple frame structure
- Reliable data delivery
- Message acknowledgement
- Energy detection and link quality indication

The simple frame structure provides a maximum payload of around 100 bytes, which is typical of the small amount of data required for the industrial and home applications. One solution based on the IEEE 802.15.4 standard is ZigBee - an internationally recognized open protocol. Interoperability is



Single-Chip Radio Module for 802.15.4/ZigBee® Applications (courtesy of CEL)

The ZigBee Interoperability Icons were created to distinguish products operating on Public Application Profiles. Interoperability Icons must be used with ZigBee Certified Products.



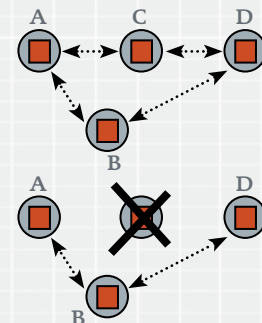
ZigBee Home Automation logo

ZigBee Smart Energy logo

one of the main requirements for the successful implementation of smart grid technology. It is supported by the ZigBee Alliance, which ensures interoperability and compatibility of components from a wide range of suppliers.

A significant advantage of ZigBee networks is their ability to mesh – i.e. to use other nodes as repeaters to relay a message to another node that is out of the maximum 76 meters (250 feet) range. Such networks are also self-healing - messages are automatically rerouted around a node that has failed. The 2.4 GHz ISM (industrial, scientific, and medical) band used by ZigBee has been set aside for unlicensed operation, meaning anyone is allowed to use it without having to obtain a license from a governmental regulatory body. ■

More information at: www.zigbee.org



In a mesh network, a wireless node can use other nodes as repeaters to relay a message to a second node that is out of its range, making them self-healing.