



Institute for
Infocomm Research

I²R
Institute for Infocomm Research
Co. Reg. No. 199801638C
21 Heng Mui Keng Terrace
Singapore 119613
Tel: (65) 6874 7588 Fax: (65) 6776 8109
www.i2r.a-star.edu.sg

Media Release

I²R's High Data-Rate Enhancement Design wins IES Prestigious Engineering Achievement Award 2005

IEEE adopts Data-Rate Enhancement Design in Wireless Standards

Singapore, 7 November 2005 – A team of engineers from A*STAR's Institute for Infocomm Research (I²R) won the Institution of Engineers Singapore (IES) Prestigious Engineering Achievement Award 2005 for their work on *Data-Rate Enhancement Design* for wireless personal area networks (WPANs). The team, comprising of Dr Francois Chin, Mr Kwok Yuen Sam and Dr Lei Zhongding, receive their IES award from Mr Mah Bow Tan, Minister for National Development, at the IES 39th Annual Dinner & Dance, held at Ritz Carlton Hotel on 28 October.

The project achieves a data rate of six times higher than the current IEEE (Institute of Electrical and Electronics Engineers, Inc.) 802.15.4 standard (see Annex A for technical details). After undergoing a vigorous scrutiny process by IEEE standards body, the design has been adopted by IEEE in the wireless standards (802.15.4b).

Based on the current standard, low cost and power communications are achieved, at the expense of data rate. The new transmission design enables high rate, low cost and power communications in WPANs.

"We are happy that the work of our researchers is being recognised by IES. This is a testimonial to the capability by our institute in conducting innovative and world-class quality R&D in Singapore. The acceptance by IEEE wireless standards will directly contribute towards the potential of wireless communication," said Prof Lawrence Wong, the Executive Director of I²R.

A WPAN is a personal network for interconnecting devices such as personal computers (PCs), personal digital assistants (PDAs), cell phones, wireless tags and consumer electronics wirelessly. The main goals of a WPAN are ease of installation,

reliable data transfer, short-range (within 100 meters) operation, extremely low cost and a reasonable battery life, while maintaining a simple and flexible protocol.

With the enhanced capability in WPANs, portable and mobile computing devices are able to communicate and inter-operate with one another more effectively, without creating a bottleneck situation in complex applications. This is expected to boost the pervasiveness of mobile computing in daily activities around us.

- End -

Background

About Institution of Engineers Singapore (IES)

IES is a national society of engineers in Singapore and the Prestigious Engineering Achievement Awards are presented annually to recognise the outstanding achievements of engineers.

Website: www.ies.org.sg

About Institute of Electrical and Electronics Engineers, Inc. (IEEE)

The IEEE is a non-profit, technical professional association of more than 365,000 individual members in approximately 150 countries. Through its members, the IEEE is a leading authority in technical areas ranging from computer engineering, biomedical technology and telecommunications, to electric power, aerospace engineering and consumer electronics, among others.

Website: www.ieee.org

About Institute for Infocomm Research (I²R)

The Institute for Infocomm Research (I²R) is a member of the Agency for Science, Technology and Research (A*STAR) family. Established in 2002, our mission is to advance infocomm technologies for the benefit of humanity and prosperity of Singapore.

I²R integrates R&D in information, communications and media (ICM) technologies to develop holistic solutions across the ICM value chain. Our research capabilities are in information technology and science, wireless and optical communications, and media analysis, processing and applications. We seek to enable technologies and processes that will drive new and enhanced services for Singapore's knowledge-based economy.

Website: www.i2r.a-star.edu.sg

For media enquiries, please contact:

Ms Patricia Loh

Assistant Manager, Corporate Communications

Institute for Infocomm Research (I²R)

Tel: (65) 6874 8003 Fax: (65) 6775 9923

Email: patricia@i2r.a-star.edu.sg

Annex A

About the design put forth by I²R

The current IEEE 802.15.4 standard devices work in either 868 / 915 MHz (Sub-GHz) or 2.4 GHz. A device for Sub-GHz band has typical coverage of around 30 ~ 60 meters whereas a device in 2.4GHz band has a range of less than 15 meters. The data rate for 2.4 GHz devices is 250 kbps, while the data rate of Sub-GHz band devices is as low as only 20 / 40 kbps for 868 MHz / 915 MHz which can cause bottlenecks for some applications.

The objective of the project is to provide specific enhancements (data-rate) to current IEEE 802.15.4 standard while keeping the characteristics of low-complexity, low cost and low power for WPANs or short range wireless networks.

The project, which involves the transmission design of a physical layer with a novel code mapping and modulation, achieves higher data rate / larger coverage communications as compared to the current standard. In addition, the transmission design has realized two modes of transmission in one sensor device with one band. The two modes are the enhanced peak data rate transmission mode and the larger coverage transmission mode with lower data rate. More importantly, the two modes can be adapted to the application to trade-off data rate and coverage without incurring additional cost / implementation complexity.

The detailed comparisons with the current technologies are as follows:

- **New standard (250kbps in 915MHz) as compared current standard (40 kbps in 915 MHz)**
 - The design improves data rate by more than 6 times
 - The design achieves a typical 30 meter coverage for the peak data rate transmission at 250 kbps and maintains the larger 60 meter coverage for the lower data rate transmission at 40 kbps under the line-of-sight propagation scenario
 - Cost / power consumption is increased marginally (less than 20%)

➤ **New standard (250kbps in 915MHz) as compared current standard (250 kbps in 2.4 GHz band)**

- The design improves by 2 times the WPAN coverage for the peak data rate transmission at 250kbps in all scenarios
- The design achieves a typical 30 meter coverage for the peak data rate transmission at 250 kbps and 60 meter coverage for the lower data rate transmission at 40 kbps as opposed to 15 meter coverage under the line of sight scenario
- Cost / power consumption of our design is less (~20% less)

The table below summarizes the above comparisons.

	Current IEEE 802.15.4 (915MHz)	New IEEE 802.15.4b (915MHz) (Our proposal)	Current IEEE 802.15.4 (2.4GHz)	New IEEE 802.15.4b (915MHz) (Scheme B)
Bandwidth	2 MHz	2 MHz	5 MHz	2 MHz
Chip rate	600 kcps	1Mcps	2Mcps	1.6Mcps
Data rate	40 kbps	250kbps / 40 kbps	250kbps	250kbps
Typical range (under LOS)	~60m	~30m (250kbps) ~60m (40kbps)	~15m	~40m
Cost / power	~ 0.8 x	1 x	~ 1.2 x	~2 x

Table 1

Summary of comparisons between existing and new IEEE standards for low-cost low-power WPAN

One of the example applications using the I²R's transmission design is dense sensor deployment in industry / warehouse settings where sensors are used to update the central controller periodically with information such as stock number, item title, item description, storage conditions like temperature, humidity, pollution condition etc. By using our transmission design, the advantages over current standard transmission schemes are:

- Each item with wireless sensor device in the warehouse can update 5 or 6 times more information or with 5 or 6 times more numeric precision per update. For instance, instead of updating temperature only information, the

device could update other information as well like humidity, pollution condition etc. in one go; or

- Each warehouse can accommodate 5 or 6 times more items with wireless sensor devices with the same information update rate; or
- Given the same information within each update packet, each sensor needs to update information less frequently, thereby generating less interference to other co-located and co-channel networks.