

Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [Capsule endoscope using an implant WBAN]

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Re: [Response to CFA]

Abstract: [The contribution illustrates a capsule endoscope as an application of an implant WBAN. This work is a result of collaboration among several companies and academia. An implant WBAN should be taken into account together with a wearable WBAN in order to achieve interoperability of them in standard because an implant WBAN is important for medical healthcare which is a primary application of WBAN.]

Purpose: [To provide information on body area network use cases and typical requirements.]

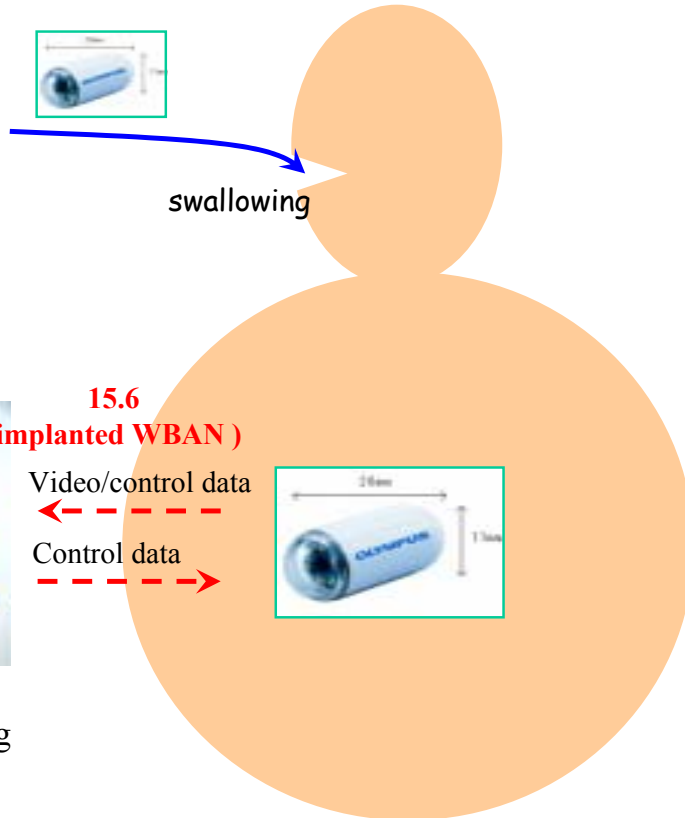
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Summary

- Capsule endoscope
 - Implanted WBAN medical application
 - Using 15.6 to enable wireless transmission of both video and control data between inside and outside of human body.
 - Cooperation with wearable WBAN is required to provide a reliable system
 - Technical requirements
 - Data rate of up to 10 Mbps
 - Sensitive to latency and error
 - Low power consumption
 - Safety for human body: compliance with SAR guidelines

Application: Capsule Endoscope



- Storage
- Real-time monitoring

- Application category
 - Medical application
 - Monitoring the digestive organs such as the small intestine by video or successive image data

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Application Classes

	Low Rate/Control	Med Rate/Audio	High Rate/Video
Medical	<ul style="list-style-type: none"> • Long-term Telemonitoring • Long-term Telemonitoring 2 • Short-term Diagnostic Monitoring • Wireless Monitoring • QoS-based BC/E • Intelligent Drug Delivery • Hospital Patient • Patient Control 	<ul style="list-style-type: none"> • Cardiac Monitoring • Prosthetic Monitoring • ECG (24-hour) • Hearing Aid • Implant Control 2 	<ul style="list-style-type: none"> • Video Endoscope (Control) • Video Endoscope (Image) • Other video
Consumer	<ul style="list-style-type: none"> • Sports/Fitness • Portable QoS Control 	<ul style="list-style-type: none"> • Handshakes • Headset • e-Chain • Custom Capsule (N-Base) • Data Storage 	<ul style="list-style-type: none"> • Remote IRIS/Chips • Video headset • Wireless (or wired) data storage

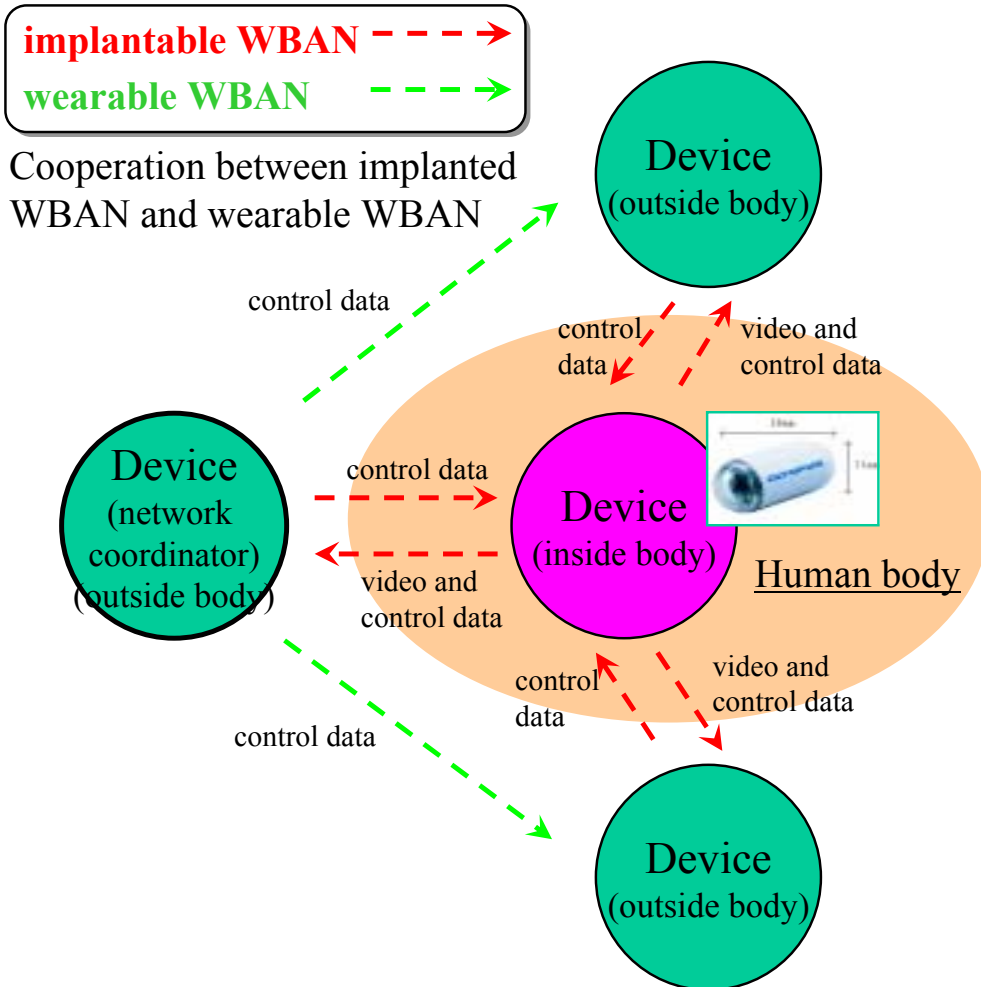
Submission

Slide 3

Richard M. Soley, NICTD

- Application environments
 - Hospital
 - Outside hospital
 - Coexistence with other radio systems

Technical overview



- Video data
 - High definition (HD)
 - Example:
 - Resolution: 720i (1280 x 720)
 - Max frame rate: 30 fps
 - Compression rate: 1/80
 - Data rate: 8.25 Mbps
 - Standard definition (SD)
 - Example:
 - Resolution: 640 x 480
 - Max frame rate: 30 fps
 - Compression rate: 1/80
 - Data rate: 2.8 Mbps
 - Control data
 - Command length (typical): 128 bits
 - QoS: low latency of less than 50 ms
 - Operation time: 8 or more hours
 - Number of devices: 2 or more devices for realizing a diversity reception
 - Safety: SAR and coexistence with other radio systems

Technical requirements

SAR Safety	Regulatory - Radio	Topology	data link speed symmetric/asymmetric	Data rate (per link)	Number of devices (per piconet)	Radio range	Coexistence
compliance with international regulations	MICS, MedRadio, and FCC part 15.209	tree or mesh	asymmetric	SD: 2 Mbps or more HD: up to 10Mbps	2~16	up to 3m from human body	yes

robustness /reliability (high/med/low)	power consumption	QoS (Sensitive to error)	QoS (Sensitive to latency)	Setup time for a new link	location awareness	channel (e.g. in/out body)	Form Factor
high	low	very sensitive	sensitive (should be less than 50ms)	less than 500ms	required, if possible	between inside and outside body	swallowable (eg. 1cmx1cmx2cm)

Number of simultaneously operating piconets	Priority
more than 2 (with transmission power control)	video data should have higher priority than other data.

ref. 15-07-0735-08-0ban-ban-application-matrix

Conclusion

- Capsule endoscope
 - Implanted WBAN medical application
 - Wireless transmission of video and control data between inside and outside body using 15.6.
 - Cooperation with wearable WBAN is required to make the system more reliable.
 - Technical requirements
 - data rate: up to 10Mbps for HD video data
 - low latency: less than 50ms
 - low power consumption: 8 or more hours by one battery
 - safety for human body: compliance with international SAR regulation or guidelines