

New Technology to Use Human Body As Digital Transmission Path

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Nippon Telegraph and Telephone Corporation (NTT) is pursuing research and development of an innovative Human Area Networking technology called RedTaction (*1) that safely turns the surface of the human body into a data transmission path at speeds up to 10 Mbps between any two points on the body. Using a novel electro-optic sensor (*2), NTT has already developed a small PCMCIA card-sized prototype RedTaction transceiver. RedTaction enables the first practical Human Area Network between body-centered electronic devices and PCs or other network devices embedded in the environment via a new generation of user interface based on totally natural human actions such as touching, holding, sitting, walking, or stepping on a particular spot.

RedTacton can be used for intuitive operation of computer-based systems in daily life, temporary one-to-one private networks based on personal handshaking, device personalization, security, and a host of other applications based on new behavior patterns enabled by RedTacton. NTT is committed to moving RedTacton out of the laboratory and into commercial production as quickly as possible by organizing joint field trials with partners outside the company, under NTT's comprehensive producer (*3) program.

Background

Human society is entering an era of ubiquitous computing, when networks are seamlessly interconnected and information is always accessible at our fingertips. The practical implementation of ubiquitous services requires three levels of connectivity: Wide Area Networks (WAN), typically via the Internet, to remotely connect all types of servers and terminals; Local Area Networks (LAN), typically via Ethernet or WiFi connectivity among all the information and communication appliances in offices and homes; and Human Area Networks (HAN) for connectivity to personal information, media and communication appliances within the much smaller sphere of ordinary daily activities--the last one meter. NTT's RedTacton is a break-through technology that, for the first time, enables reliable high-speed HAN. In the past, Bluetooth, infrared communications (IrDA), radio frequency ID systems (RFID), and other technologies have been proposed to solve the "last meter" connectivity problem. However, they each have various fundamental technical limitations that constrain their usage, such as the precipitous fall-off in transmission speed in multi-user environments producing network congestion.

Technical Points

RedTacton takes a different technical approach. Instead of relying on electromagnetic waves or light waves to carry data, RedTacton uses weak electric fields on the surface of the body (*4) as a transmission medium. A RedTacton transmitter couples with extremely weak electric fields on the surface of the body. The weak electric fields pass through the body to a RedTacton receiver, where the weak electric fields affects the optical properties of an electro-optic crystal. The extent to which the optical properties are changed is detected by laser light which is then converted to an electrical signal by a detector circuit.

The three major functional features of RedTacton are highlighted below.

- (1) A communications path can be created with a simple touch, automatically initiating the flow of data between a body-centric electronic device and a computer that is embedded in the environment. For example, two people equipped with RedTacton devices could exchange data just by shaking hands. A wide range of natural human actions -- grasping, sitting down, walking, or standing in a particular place -- can be used to trigger RedTacton to start a networked process.
- (2) Using a RedTacton electro-optic sensor, two-way communication is supported between any two points on the body at a throughput of up to 10 Mbps. Communication is not just confined to the surface of the body, but can travel through the user's clothing to a RedTacton device in a pocket or through shoes to communicate with a RedTacton device embedded in the floor. Unlike wireless technologies, the transmission speed does not deteriorate even in the presence of large crowds of people all communicating at the same time in meeting rooms, auditoriums or stores. Because the body surface is the transmission path, increasing the number of connected users directly increases the available number of individual communication channels .
- (3) RedTacton can utilize a wide range of materials as a transmission

medium, as long as the material is conductive and dielectric, which includes water and other liquids, various metals, certain plastics, glass, etc. Using ordinary structures such as tables and walls that are familiar and readily available, one could easily construct a seamless communication environment at very low cost using RedTacton . (Note that constraints are imposed by the length and environment of the propagating conductor, and by the thickness of the dielectric.)

Potential Applications

- One-to-One services

With the ability to send attribute data from personal information devices worn on the body to computers embedded in the environment, one-to-one services could be implemented that are tailored to the individual needs of the user.

- Intuitive operation of personal information devices

Communication is triggered by totally natural human actions and behavior, so there is no need to insert smart cards, connect cables, tune frequencies, or any of the other inconveniences usually associated with today's electronic devices.

- Device personalization

Setup, registration, and configuration information for an individual user can all be uploaded to a device the instant the device is touched, eliminating the need for the device to be registered or configured in advance.

- New behavior patterns

Tables, walls, floors and chairs can all act as conductors and dielectrics, turning furniture and other architectural elements into a new class of transmission medium. For example, a user could have instant access to the Internet merely by placing a laptop onto a conductive tabletop.

- Security applications

RedTacton could be installed on doors, cabinets and other locations calling for secure access, such that each secure access could be initiated and authenticated with a simple touch. At the same time, all the transaction details and relevant user attributes (personal identity, security clearance, etc.) could be logged by the security system.

Enlisting Partners for Collaborative Field Trials

NTT hopes to conduct joint field trials in cooperation with outside companies and organizations to explore potential applications, verify RedTacton reliability, fine-tune the system, and gather business and market data.

- Trial period: from April to September, 2005 (planned)
- RedTacton equipment: NTT will lend partners RedTacton transceiver prototypes. Maintenance fees incurred during the field testing will be borne by the partners.
- Trial environment: Partners will prepare the staffing, equipment, and venues needed to operate the field trials.
- Partner selection: Trial partners will be selected at the sole discretion of NTT.
- Further Information: Inquiries about RedTacton or proposals to participate in joint field trials can be submitted through the RedTacton website (www.redtacton.com).

Future developments

RedTacton has a wide range of unique new functional features and enormous potential as a Human Area Networking technology. NTT is committed to quickly identifying and opening up those application areas with the the most commercial promise for RedTacton, a business

development process to be coordinated under NTT's Comprehensive Producer Function program.

Glossary

***1) RedTacton**

RedTacton involves initiating communication with a touch that could result in a wide range of actions in response. So, NTT combined touch and action to coin the term Tacton, and then added the word Red -- a warm color -- to emphasize warm and cordial communications, creating the name RedTacton. For more information about RedTacton, please visit the RedTacton webpage at www.redtacton.com/.

***2) Electro-Optic sensor**

A sensor that bounces a laser beam off of a crystal (electro-optic crystal) and measures the reflected beam. Oscillations in the electric field surrounding the crystal affect the crystal, which changes the reflected light's polarization.

***3) Comprehensive Producer Function**

The Comprehensive Producer Function initiative is an NTT internal program launched in July 2003 in which "Producers" within the NTT Holding Company are made responsible for commercialization planning, business development and market research for new technology invented by NTT Labs. The Producers work together with various parties both inside and outside the NTT Group to get NTT's renowned R&D out of the lab and into the marketplace as quickly as possible. NTT plans to apply this commercialization program to a broad range of products and services in the years ahead.

***4) Body surface electric fields**

RedTacton transceiver electrodes are covered with an insulating film, so there is no way that current from RedTacton can flow into the user's

body. Note however that, just like the weak electromagnetic waves produced by most common electrical appliances, a faint modulating displacement current does pass through the body when using RedTacton . The level of displacement current involved is considered harmless and is in full compliance with the Ministry of Internal Affairs and Communications (MIC) safety guidelines (RCR STD-38).

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