RED TACTON (An avant-garde Human Area Networking technology)

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Abstract: *So many technologies for networking are known and are in use. These technologies connect people, objects and other networks together so as to share data and thus make information ready for access. Our body could soon be the backbone of a broadband personal data network linking your mobile phone or MP3 player to a cordless headset, your digital camera to a PC or printer, and all the gadgets you carry around to each other.*

A new networking technology called RedTacton was announced by NTT labs in 2005, which makes use of human body surface as communication medium when exchanging data among people, objects and networks. It is completely distinct from wireless and infrared. RedTacton has contrived a new pattern of behavior which defines different application areas of the technology. With this new technology ubiquitous computing services is enhanced. This is because it brings user-friendly ubiquitous services to people and objects in a network, in very close proximity. A transmission path is formed at the moment a part of the human body in contact with a RedTacton transceiver. Physically separating ends the contact and thus ends communication.

*It is a Human Area Networking technology that uses the surface of the human body as a safe, high speed network transmission path. Communication is possible using any body surfaces, such as the hands, fingers, arms, feet, face, legs or torso. RedTacton works through shoes and clothing as well. So we, in this paper are explaining the unique new functional features and enormous potential of **RedTacton as a Human Area Networking technology**.*

I. Introduction:

RedTacton is a new Human Area Networking technology introduced by Nippon telegraph and Telephone Corporation(NTT's) that uses the surface of the human body as a safe, high speed network transmission path. 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.

1.1. What is RedTacton?

RedTacton was introduced by Nippon Telegraph and Telephone Corporation(NTT) who combined TACTON - "touch-act-on" Meaning "action triggered by touching" and RED - It is an auspicious color according to Japanese culture for warmth and love creating the name RedTacton. It is a technology that uses the surface of the human body as a safe, high speed network transmission path. The study of Human Area Networking,

(i)   RedTacton uses the minute electric field emitted on the surface of the human body. Technically, it is completely distinct from wireless and infrared.
(ii) A transmission path is formed at the moment a part of the human body comes in contact with a RedTacton transceiver. Physically separating ends the contact and thus ends communication.
(iii) Using RedTacton, communication starts when terminals carried by the user or embedded in devices are linked in various combinations according to the user's natural, physical movements.
(iv) Communication is possible using any body surfaces, such as the hands, fingers, arms, feet, face, legs or torso. RedTacton works through shoes and clothing as well.

1.2 Features of RedTacton:
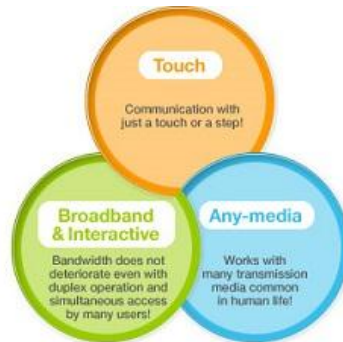RedTacton has three main functional features:

Fig-1 Features of RedTacton

(i) Touch: Touching, gripping, sitting, walking, stepping and other human movements can be the triggers for unlocking or locking, starting or stopping equipment, or obtaining data.
(ii) Broadband & Interactive: Bandwidth does not deteriorate even with duplex operations and simultaneous access by many users! Duplex, interactive communication is possible at a maximum speed of 10Mbps. Because the transmission path is on the surface of the body, transmission speed does not deteriorate in congested areas where many people are communicating at the same time.
(iii) Any media: In addition to the human body, various conductors and dielectrics can be used as transmission media. Conductors and dielectrics may also be used in combination.

1.3 Background:

Intra-body communication was proposed for the first time by IBM in 1996 and was eventually appraised and reported by several research bodies on the globe. However, many of these reported technologies were prone to shortfalls including operating range (of tens of centimeters) and speed, which is only 40 bits/s. 2 Similarly, technologies such as infrared, Bluetooth and Radio Frequency ID System(RFID) are in use and were proposed to address what is termed "last meter" connectivity problem. But shortcomings such as the sudden decrease in speed of transmission especially in multi-user environment leading to network congestion were peculiar to them.

The solution to all these problems is therefore RedTacton which is an implementation of ubiquitous network services among other two connectivity levels (WAN and LAN) for connectivity to personal information, media and communication devices in a sphere of ordinary daily activities (achieving the last one meter). This condition of network system is thus termed HAN.

II.   RedTacton Mechanism of Operation:

2.1 Working:

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 as a transmission medium as shown in Fig-2.
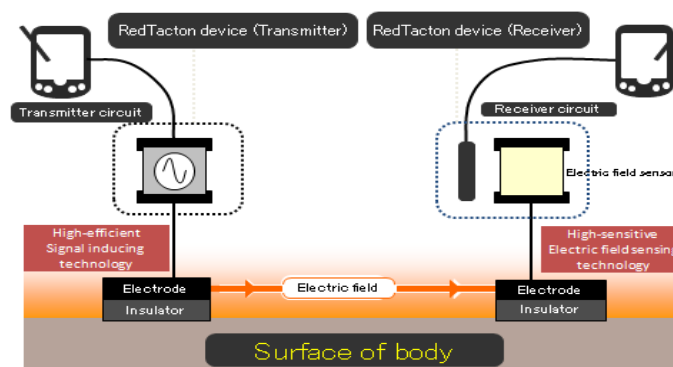

Fig-2 How RedTacton works

(i) The RedTacton transmitter induces a weak electric field on the surface of the body.
(ii) The RedTacton receiver senses changes in the weak electric field on the surface of the body caused by the transmitter.

(iii) RedTacton relies upon the principle that the optical properties of an electro-optic crystal can vary according to the changes of a weak electric field.

(iv) RedTacton detects changes in the optical properties of an electro-optic crystal using a laser and converts the result to an electrical signal in an optical receiver circuit.

Multiple transceivers can be used simultaneously. This is because RedTacton uses a proprietary CSMA/CD (Carrier Sense Multiple Access with Collision Detection) protocol that allows multiple access with the same medium from multiple nodes.

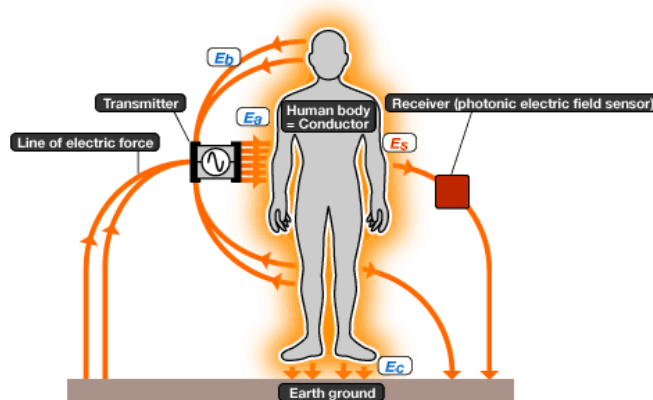**2.2 Mechanism of communication with RedTacton:**

Fig-3RedTacton workability across human path

The naturally occurring electric field induced on the surface of the human body dissipates into the earth as shown in Fig-3. Therefore, this electric field is exceptionally faint and unstable. The photonic electric field sensor developed by NTT enables weak electric fields to be measured by detecting changes in the optical properties of an electro-optic crystal with a laser beam.

2.3 RedTacton transceiver:

The transmitter consists of a transmitter circuit that induces electric fields toward the body and a data sense circuit, which distinguishes transmitting and receiving modes by detecting both transmission and reception data and outputs control signals corresponding to the two modes to enable two-way communication as shown in Fig-4.
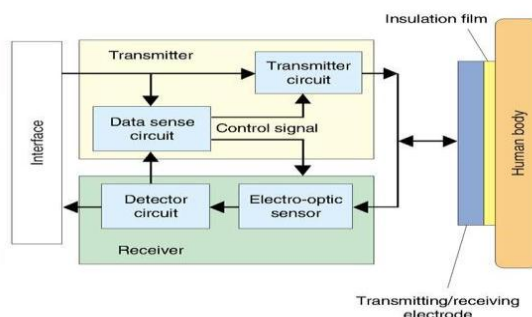

Fig-4 Block diagram of RedTacton transceiver

Implementation of receive-first half-duplex communication scheme that sends only after checking to make sure that there is no data to receive in order to avoid packet collisions. RedTacton takes advantage of the long-overlooked electric field that surrounds the human body.

III. RedTacton Ubiquitous Services:

Existing communication technologies in the range of wired and wireless communication technologies allow for easy connections (no connectors required) as signals are available but the signals can fade out causing connection time out. More so, the coming signals can be intercepted as they arrive (posing security concerns).

Wired technologies on the other hand transmit signals between two ends and thus guide against interceptions (thereby guaranteeing security). But here, wires between ends can become worrisome.

RedTacton is positioned between wireless and wired technologies and it is that one meter solution to close-range communication. The close-range communication is the result of focus on ubiquitous computing services and has been achieved through RedTacton. RedTacton is therefore a hybrid of wired and wireless systems. It allows for connection without connectors and also allows data transmission only between two contact points thus guaranteeing security. Table I below compares RedTacton with other networks to further show its efficacy as a ubiquitous computing promoter.

Apart from the comparison analysis in the table I, RedTacton characteristic features support ubiquitous services. Through touch feature there can be triggers for locking or unlocking purposes, starting or stopping machines, or acquiring data. Any of these conditions can bring about communication making computing presence "everywhere". With the broadband and interactive feature, duplex communication is achieved at throughput speed of 10mbps.

RedTacton has wide variety of services; some of the services are as follows:

3.1 One-to-one services:

- Enable one-to-one services tailored to the user's situation and tastes.

- Attribute information recorded in the RedTacton device is sent to the touched objects.

- The appropriate service is provided based on the attribute information received by the RedTacton receiver.

3.1.1 Elimination of human error:
- RedTacton devices embedded medicine bottles transmit information on the medicines attributes. If the user touches the wrong medicine, an alarm will trigger on the terminal he is carrying.

Fig-2 Elimination of human error (Medicinal use)

- The alarm sounds only if the user actually touches the medicine bottle, reducing false alarms common with passive wireless ID tags, which can trigger simply by proximity. Risk avoidance at construction sites. (An alarm sounds if special equipment is handled by anyone other than supervisors)

3.1.2 Marketing Applications:
- When a consumer stands in front of an advertising panel, advertising and information matching his or her attributes is automatically displayed.
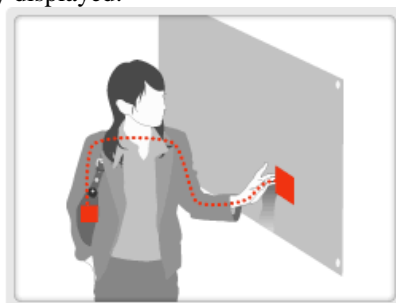

Fig-3 Marketing Applications

- By touching or standing in front of items they are interested in, consumers can get more in-depth information.
- Inside a shop, shoppers can view related information on their mobile terminals immediately after touching a product.

3.2 Intuitive operations:
- Natural movements and actions are the trigger (touch).

- RedTacton transceivers embedded in twoterminals can communicate not only data butalso the control or configuration instructionsneeded to operate devices (broadband &interactive).

3.2.1 Intuitive Operations:

Fig-4 Desired printing using RedTacton

- Print out where you want just by touching the desired printer with one hand and a PC or digital camera with the other hand to make the link as shown in Fig-7.
- Complicated configurations are reduced by downloading device drivers "at first touch".
- Transfer songs to portable music players from notebook PCs with just a touch.

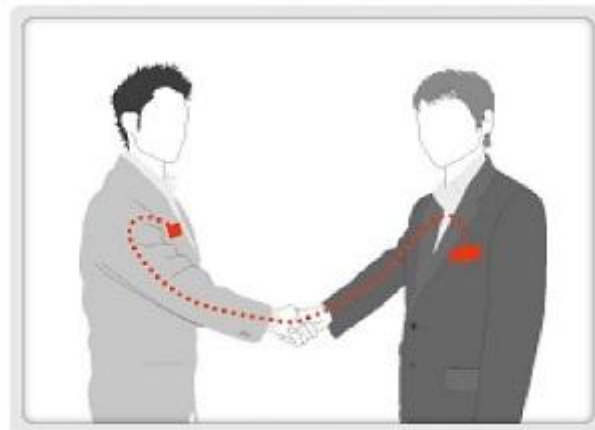**3.2.2 Instant private data-exchange:**

Fig-5 Instant private data-exchange

- By shaking hands, personal profile data can be exchanged between mobile terminals on the user. (Electronic exchange of business cards)
- Communication can be kept private using authentication and encryption technologies.
- Group photos taken with digital cameras are instantly transferred to individual's mobile terminal.
- Diagrams written on white boards during meetings are transferred to individual's mobile terminals on the spot.

4.3 Personalization:

- Digital lifestyle can be instantly personalized with just a touch.
- A pre-recorded configuration script can be embedded in a mobile terminal with built-in RedTacton transceiver.
- When another device with RedTacton capabilities is touched, personalization data and configuration scripts can be downloaded automatically.

4.3.1 Personalization of mobile phones:

- Your own phone number is allocated and billing commences.
- Automatic importing of personal address book and call history.
- The PC is configured to the user's specifications simply by touching the mouse.

Fig-6 Personalization of mobile phones

3.3.2 Personalization of automobiles:

Fig-7 Personalization of automobiles

- The seat position and steering wheel height adjust to match the driver just by sitting in the car.
- The driver's home is set as the destination in the car navigation system.

3.4 New behavior pattern:

- Various conductors and dielectrics can be used as RedTacton communication media and this has the potential to create new behavior patterns. Walls and partitions can be used as communication media.

3.4.1 Conferencing System:

- An electrically conductive sheet is embedded in the table. A network connection is initiated simply by placing a laptop on the table.
- Using different sheet patterns enables segmentation of the table into subnets.
- Walls and partitions can be used as communication media, eliminating construction to install electrical wiring.

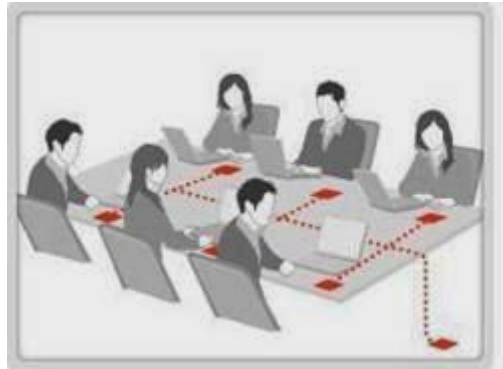- Ad hoc networking using conductive liquid sprays is possible.

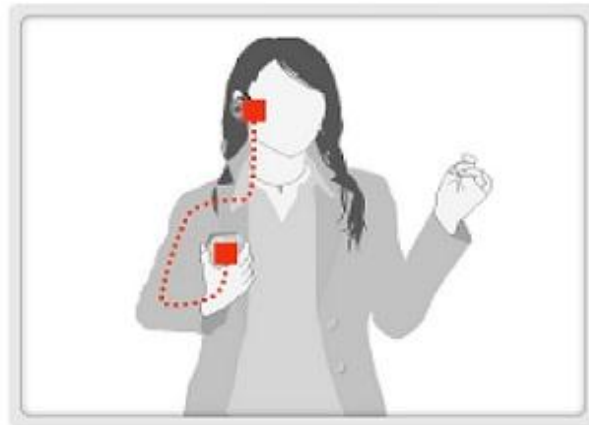**Fig-8 Conferencing System**

3.4.2 Wearable:

Fig-9 Wearable

- RedTacton can carry music or video between headsets, mobile devices, mobile phones, etc.
- Users can listen to music from a RedTacton player simply by putting on a headset or holding a viewer.
- Connecting head mounted displays.

3.5 Security Applications:
- Automatic user authentication and log-in with just a touch.
- ID and privileges are recorded in a mobile RedTacton device.
- Corresponding RedTacton receivers are installed at security check points.
- The system can provide authentication and record who touched the device, and when.

4.5.1 User Verification Management:

Fig-10 User-verification management

- Carrying a mobile RedTacton-capable device in one's pocket, ID is verified and the door unlocked when the user holds the doorknob normally.
- Secure lock administration is possible by combining personal verification tools such as fingerprint ID or other biometric in the mobile terminal.

IV. Advantages:

- RedTacton does not require the electrode be in direct contact with the skin.
- High-speed communication is possible between two arbitrary points on the body.
- Body-based networking is more secure than broadcast systems, such as Bluetooth which have high range of about 10m.
- Network congestion due to fall in transmission speed in multiuser environments is avoided.
- Superior than Infrared technology
- Superior than Wi-Fi.

V. Disadvantages:

- It has no compelling applications that aren't already available.
- Too costly.

VI. Safety Alert:

RedTacton has no effect on the body surface of the human medium as transmission and reception take place. This is because the RedTacton transceivers are completely protected by insulin film which insulates the body path. Nonetheless, it should be noted that some displacement current is generated by the electrons in the body due to minute electrical fields. However, such displacement currents are common to us especially with the use of most electrical appliances and are within the standards [RCRSTD-38] issued by the Association of Radio Industries and Businesses [ARIB].

6.1 Human Safety:

(i) The transmitting and receiving electrodes of the RedTacton transceiver are completely covered with insulating film, so the body of the person acting as the transmission medium is completely insulated. This makes it impossible for current to flow into a person's body from the transceiver.

(ii) When communication occurs, displacement current is generated by the electrons in the body because the body is subjected to minute electrical fields. However, such displacement currents are very common everyday occurrences to which we are all subjected.

VII. RedTacton and other technologies:

RedTacton when compared with other non-wire/ wireless technologies using different criteria, the following table information is the outcome.

| | Evaluation criteria | Wireless | | | | Infrared data communication | RED TACTON |
		Wireless LAN	Close range wireless	Contactles IC cards	Passive wireless ID tag		
Communication performance	Transfer speed	E	P	P	P	P	E
	Performance deterioration during periods of communication	E	P	P	P	P	E
	Duplex data transfer	E	E	E	P	E	E
User convenience	Data configuration at initiation of communications	E	E	P	P	E	E
	Tasks required at time of each communication	E	E	P	E	P	E
	Synchronization with user behavior	P	P	E	E	P	E

E: Excellent   P: Poor

Table-1 Comparing RedTacton with other technologies

VIII.   Conclusion:

Human body networking is more secure then broadcast systems, such as Bluetooth, which have a range of about 10m.With Bluetooth; it is difficult to rein in the signal and restrict it to the device you are trying to connect to. You usually want to communicate with one particular thing, but in a busy place there could be hundreds of Bluetooth devices with in a range. As human beings are effective in aerials, it is very hand to pick up stray electronic signals radiating from the body. This is good for security because even if you encrypt data it is still possible that it could be decoded, but if you can't pick it up it can't be.

RedTacton use of electro-photonic field sensor approach has earned in an edge above others technologies and has shown is the last 1m close-range technology. Its communication distance, speed of transfer, and interactivity has enhanced its ubiquitous services. RedTacton has no security issue as human body surface is the communication path and connection is between ends. A good handshake exists among devices and people. The main issue today is speed and has been resolved by RedTacton by giving 10mbps speed within a proximity range (1m).

In the near future, as more and more implants go into bodies, the most important application for body-based networking may well be for communications within, rather than on the surface of, or outside, the body. An intriguing possibility is that the technology will be used as a sort of secondary nervous system to link large numbers of tiny implanted components placed beneath the skin to create powerful onboard or in-body computers. So we can conclude that this technology will change the future of wireless communication.

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