

RedTacton: Enhancing Ubiquitous Computing Services

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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. 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. RedTacton has innovated a new patterns of behaviour which defines different application areas of the technology. With this new technology ubiquitous computing services is enhanced. This is because it brings a user-friendly ubiquitous services to people and objects in a network, in very close proximity. By just a small PCMCIA card-sized transceiver prototype, RedTacton evokes the first practical HAN comprising devices, human body(ies), PCs and other networks in an environment triggered by a natural human actions such as touching, holding, walking, swiping, stepping on a surface etc. In this article we look at RedTacton as a ubiquitous computing services enhancer.

Index Terms-- HAN , NTT, RedTacton, Ubiquitous Computing

I. INTRODUCTION

RedTacton is a new and the first realistic Human Area Network(HAN) that uses human body surface as a safe, high-speed network transmission path and PCs and other network devices that are in an environment triggered by some natural human actions. These human actions can be by touching, stepping, swiping, holding or walking on a surface among others.

Ubiquitous computing means completely connecting computing devices in a manner that they are regularly available and are everywhere. Examples of technologies of the future in this drive are wearable computers, smart homes, smart buildings etc.

RedTacton innovation was brought by NTT (Nippon Telegraph and Telephone Corporation), Japan in 2005. The

new technology will enhance how we communicate data and exchange ideas and information in multiple ways; and these conveniences are no doubt a plus for ubiquitous computing.

Many one-to-one services are possible with RedTacton. Examples of these are intuitive operations, personalization, security, health and military operations and other application areas of the technology which largely enhance ubiquity of computing. See figure below for an idea about the subject while the rest of the paper describes background information about it, mechanism of operation (working algorithm and RedTacton radio transmitter and receiver), relations to ubiquitous computing and other applications.

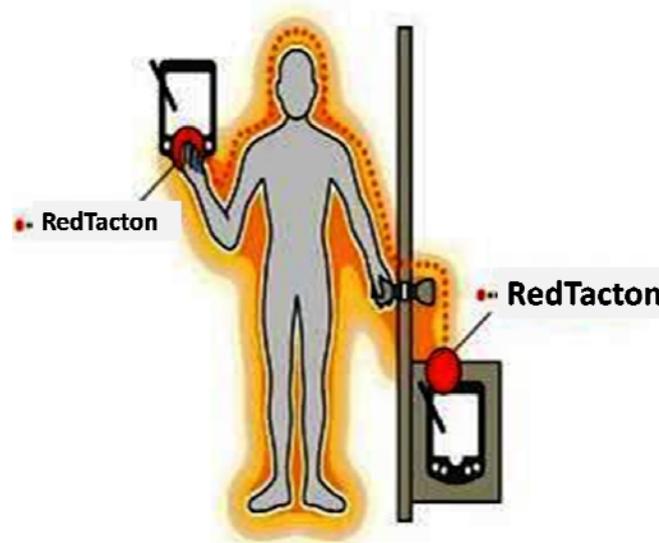


Fig. 1. RedTacton communication scenario for locking and unlocking a door by mere human touch.¹

II 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 centimetres) and speed, which is only 40 bits/s.² Similarly, technologies such as infra red, 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.

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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)³. This condition of network system is thus termed HAN.

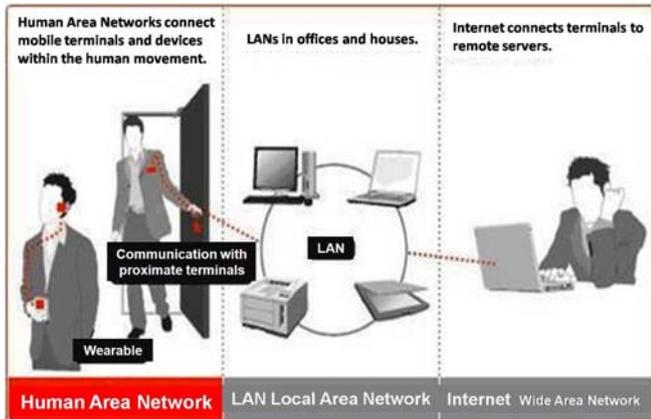


Fig. 2. RedTacton enabling a system of communication network consisting HAN, LAN and WAN by just human movement.³

III. REDTACTON MECHANISM OF OPERATION

A. Working and Algorithm

The use of superficial electro-optic sensor by RedTacton affords it a maximum speed of 10 mbps duplex communication over surface of human body. The outline below is summary of the workings of RedTacton:

- i. RedTacton transmitter induces a weak electric field on the human body surface.
- ii. The receiver of the RedTacton senses changes in the weak electric field on the surface of the body caused by the transmitter.
- iii. The RedTacton depends on the proporsition of the optical properties of an electro-optic crystal which varies according to the changes in the weak electric field.
- iv. RedTacton detects the changes in the optical properties of an electro-optic crystal using a laser and convert the result into an electrical signal in a detector circuit.¹

$E_a - E_b - E_c = E_s + \text{Use of photonic electric field sensor}$, where:

E_a , is the electric field induced by the transmitter,

E_b , is the electric field returning to the ground of the transmitter,

E_c , is the electric field at the receiver, and

E_s , is the detected electric field at the receiver.

See figure 3 and figure 4 below for schematic description of RedTacton algorithm and workings.

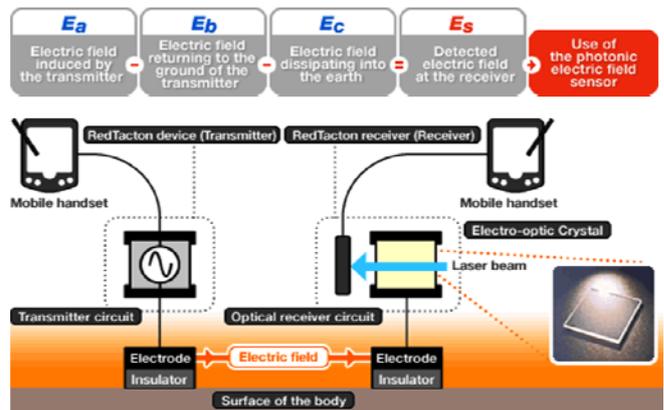


Fig. 3. RedTacton algorithm of operation.³

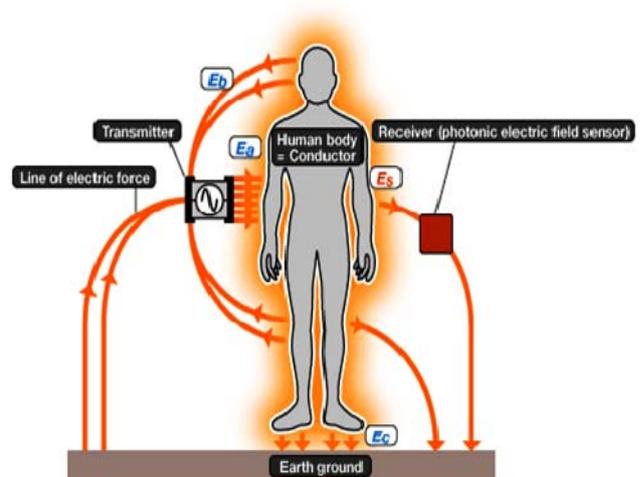


Fig. 4. RedTacton workability across human path.³

B. RedTacton Radio Transmitter and Receiver

The figures below show transmitting and receiving operating mechanism of RedTacton:

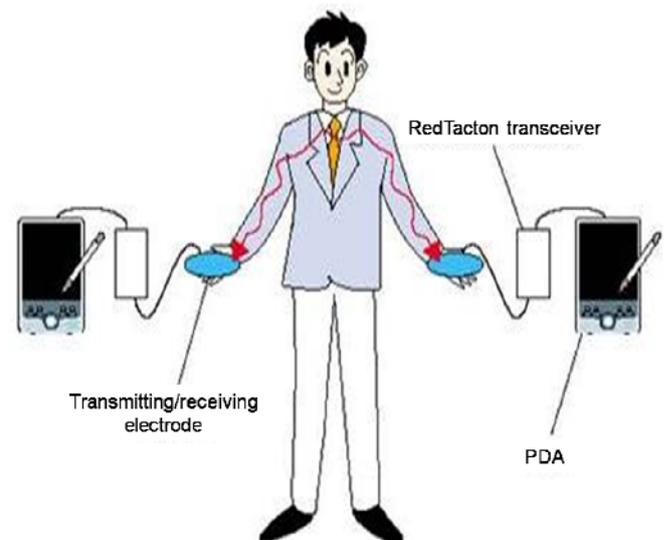


Fig. 5. RedTacton Transceiving "membrane" ⁴.

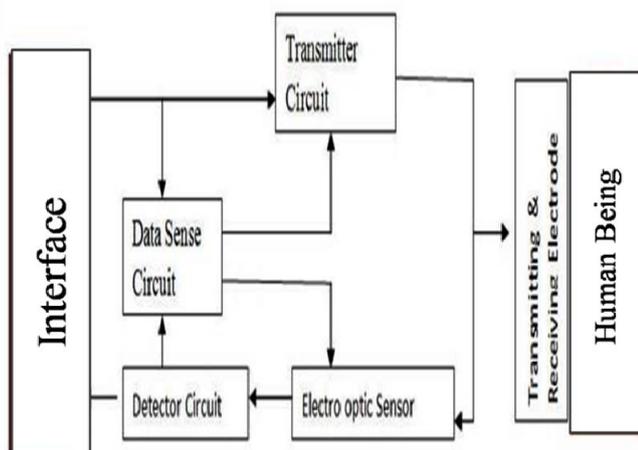


Fig. 6. RedTacton Transceiver⁴.

The transmitter receives the data signals from the interface. The transmitter circuit is invoked upon signal perception from the data sense circuit. The electro-optic sensor thus detects the changes in the electric field of the body.

IV. 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. Moreover, 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 metre* 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 an 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 supports 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.

Materials such as conductors and di-electrics can also be used as transmission media. Water surface can serve as conductor and glass,walls etc can be used as di-electrics with resultant effect on ubiquitous computing.

V. VARIOUS APPLICATIONS OF REDTACTON

RedTacton has numerous list of applicability categorized as follows:

- a. One-to-one services
- b. Intuitive operation of personal data
- c. Device personalization
- d. Security
- e. Marketing promotion
- f. New behaviour patterns
- g. Medical use
- h. Military application.

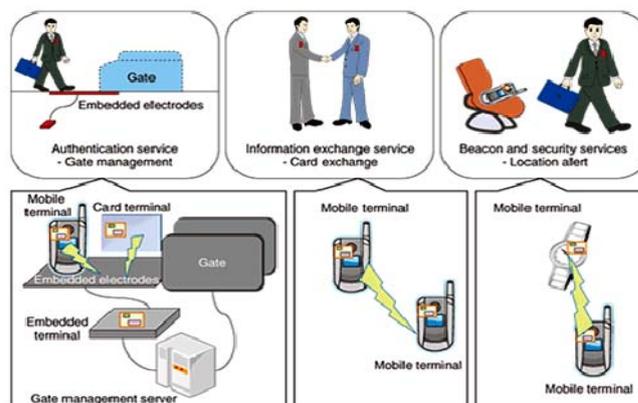


Fig. 7. A few services enabled by RedTacton⁶.



Fig. 8. Automation in Locking I



Fig. 9. Medicine analysis



Fig. 10. Automation in Locking II

The following are examples of RedTacton ubiquitous services found under above application areas:

1. Touch a printer to print.
2. Touch advert and access information.

3. Alarm buzz automatically to prevent accidental medicine ingestion.
4. Instantaneous private network through personal handshake.
5. Connect to the network just by putting a lap-top on the table.
6. User authentication and unlocking with just a touch.
7. Just sitting in the seat triggers the car to load all the presets, anyhow it is liked.
8. Confidential documents management.
9. Touching a phone turns it your own.
10. Wireless headphone connectivity.
11. Diabetes treatment etc.

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 minutes electrical fields. However, such displacement currents are common to us especially with the use of most electrical appliances and are within the standards [RCR STD-38] issued by the Association of Radio Industries and Businessess [ARIB]⁵.

VIII. REDTACTON AND OTHER TECHNOLOGIES

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

Table I Comparing RedTacton with existing technologies

Evaluation Criteria	Wireless LAN	Close Range Wireless	Contactless IC Cards	Passive Wireless ID tags	Infrared	RedTacton
Speed of Transfer: (Can DVD quality images be sent?)	E	P	P	P	P	E
Congestion effect on performance	P	P	E	E	E	E
Duplex data transfer	E	E	E	P	E	E
Data configuration at initiation of communication	E	E	P	P	E	E
Tasks required at each time of communication	E	E	P	E	P	E
Synchronization with user behaviour	P	P	E	E	P	E

Key: P (Poor), E (Excellent)

IX. CONCLUSION

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 have 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 exist 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).

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