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A Survey on communication through body

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***Abstract*—Behavior of human is changing day by day and the communication ways are becoming faster and efficient. Many technologies have been introduced of communication till date. Elimination of wires was a great achievement. Wireless communication requires some medium through which data passes. A new concept of using biological conductor i.e. human body as a communication medium introduced in 1996.The communication was in analog form. Many authors put forward their ideas about using body as an efficient way of communication. This paper will summarize the contribution of papers in intra body communication.**

Index term: HAN, PAN, Capacitive coupling, Galvanic coupling.

Section I

Zimmerman was the first man who thinks that we can use human body as a medium for data transfer. The motivation was one need not have to carry the medium but it is always with us. The human body can work as a conductor itself so passing a small amount of current through body will carry a data through it. A tremendous data is handled nowadays using mobile equipments, laptop, note and smart phone so body is going to be a valid medium for communication. The amount of current is too small (few milli-ampere) to cause any effect to human body.

The concept was just to pass data but the idea has many application in health sector so further studies has been done. This paper is organized as follows section II briefly reviews various analog methods which are implemented by different authors. Section III presents the application of idea in medical sector. Section IV explores the digital approach of data transfer. The advanced version of technique with embedded system or any other existing software as a future research is mentioned in section V. section VI will conclude the topic.

Section II

This chapter describes a model of human area networking technology that enables communication by touching, a technology we call Red Tacton. Human area networking technology for communication between mobile terminals and between terminals that are embedded in the environment has become important. When cables are used for communication between terminals, the routing of the cables is clearly inconvenient. When very weak radio signals are used for the communication, data speeds are reduced by packet collision and other such problems in crowded places such as exhibition sites and security risk from unwanted signal interception is another problem. Technology for solving such problems includes the use of the person body as a signal path for communication. A transmission path is formed automatically when a person comes into contact with a device and communication between mobile terminals begins. Here, the human body acts as a transmission medium supporting IEEE 802.3 half duplex communication at 10Mbit/s.

Author considers a human body as a conductor wrapped in an insulator. Initially an electrooptic sensor was used for data communication. The data transmitter generates a voltage corresponding to data signals between a signal electrode and its circuit ground. The electrode is attached to a human body. A typical condenser is made up of human body and electrode. Ground electrode of circuit is isolated from circuit ground and it is floating. Electrical properties of human body mainly influence the galvanic and capacitive coupling signal through body. Major factors which affect property of human cells are tissue type, operating range of frequency, temperature, intactness of cellular

membrane and water content of cell. Three types of dispersion occurred in human tissue are alpha, beta, gamma. There are different methods for human body channel modeling, including electric equivalent circuit models which are based on parametric model of human tissues. Author uses three different methods for comprehensive study of different parameters i.e. galvanic coupling, capacitive coupling and waveguide method. The first two rely on the coupling of low frequency, low-level currents and voltages into the human body, respectively, whereas in the last technique, an electromagnetic wave propagates through the body, which is commonly associated with the use of higher frequencies, thus involving a non negligible radiation component into the air.

Author did comparison of different parameter by keeping all other parameter constant. Author consider male and female as two test objects, and four types of electrodes are used. The electric field induced towards the body by the transmitter's signal electrode is represented by Ea. The system requires a ground close to the transmitter signal electrode, so electric field Eb induced from the body can follow a return path to the transmitter ground. Moreover, since people are usually standing on a floor or the ground, electric field Ec escapes from the body to ground, mainly from the feet. The electric field Es that reaches the receiver is Es= Ea-(Eb +Ec). It couples to the electro-optic crystal and changes the crystal's optical properties. This change is detected by laser light and transformed into digital data by a detector circuit. As author Chang-Hee Hyoung suggested that a transceiver module for human body communications whereby a spread signal with a group of 64 Walsh codes is directly transferred through a human body at a chip rate of 32 Mcps. Frequency spectrum over 5 MHz without continuous frequency modulation

and increases the immunity to induced interference by the processing gain. Author Ai-ichiro Sasaki and Tadao Nagatsuma uses electrooptic detector as harmonic mixer for millimeter wave imaging. The EO detector functions as the down-conversion of continuous wave (CW) MMWs. Both amplitude and phase images were simultaneously obtained with this method. frequency is selected like 60 GHz and 100 GHz and the parameters like sensitivity, patial resolution and imaging of objects are observed. Author concludes that the MMW amplitude images reflect absorption of objects, and MMW phase images reflect their refractivity. It was also observed that the spatial resolution of MMW imaging is restricted to the order of wavelength similar to that of imaging with light. Therefore, higher spatial resolution will require higher frequency MMW sources. Recently a new technique called photonic technique has been successfully used to generate MMWs and/or THz frequency signals and to make a frequency-tunable MMW imaging feasible in the future, a combination of EO-based broad-band MMW detection system with a photonic MMW generator is done.

Section III

Healthcare sensor network systems consisting of body area networks (BAN) and infrastructure area networks avoid the need for a manual self-administered health system and may enable users to take control of their health disorders in the future. This technology with miniaturized sensors worn or implanted on the body, continuously monitoring health parameters and acting to prevent the onset of critical health events. For example, diabetics now have access to an automatic insulin pump which monitors glucose levels and administers insulin when glucose levels are high. Similar technologies will one day result in devices which can minimize incidences of heart attack or stroke. They could prevent frequent hospital visits and save costs for both the individual patient and a nation's healthcare system.

In short a small chip can be implanted in a body which will be continuously monitoring the various critical organs in the body. Any malfunctioning of that will be prior informed to human to take necessary actions. Normally organs like heart, kidney, liver give symptoms

when it is going to be wrong something but humans cannot sense it as a problem. so these naturally generated symptoms will be processesd and informed to human in some form. If this technology implemented then many heart attacks or many such accidental deaths can be easily avoided. The main issue is the chip which is implanted in body does not have any side effects to human. It will pass a very small amount of current which is not even sensed. By using such type of chip a big mesh of wires and costly equipments can be avoided completely. Many experiments were performed on human and animal tissue within the frequency range of 10 Hz to 20 GHz. During the experiments the temperature was fixed (37◦C) and it was assumed that tissue layers were homogenous. The electrical properties of a living tissue were measured through the interaction between electromagnetic radiation and tissue cells. Additional research revealed that dielectric properties of living tissue vary differently with frequency dispersion.

Section IV

Success of any technology depends upon efficiency, error free data transfer, speed and many such factors. Previous analog system was not capable of providing enough transfer rates. Many authors built up a new system where digital approach was there. Transfer of binary data with some of the coding technique is implemented. Digital transfer can be done using coding languages such as C, C++, java or embedded C as per the requirement. Many devices handling these coding are available in market. Main advantage of adaptation of digital system from analog that now the system can be interfaced with processor, controller or any embedded system. Processing of collected data become efficient than previous. A new software android can be used to interface the controller with the main circuit.

Google OHA (Open Handset Alliance)

The first truly openand comprehensive platform for mobile devices, all of the software to run a mobile phone but without the proprietary obstacles that have hindered mobile innovation Linux OS kernel, Java programming, Open source libraries: SQLite, WebKit, OpenGL

Why android

A simple and powerful SDK ,No licensing, distribution, or development fees, Development over many platform Linux, Mac OS, windows, Excellent documentation, Thriving developer community For us Java-based, easy to import 3rdparty Java library Funding (40+ G1 phones)

Advantages of Mobile Apps are Efficient communication Can use any networking protocols you want requires knowledge of one language only Java for Android Objective C for iPhone Designed for small displays with touch screen So, many apps and GUI controls are optimized for this environment

Disadvantages of Mobile Apps

1. No universal access
2. Must be installed one at a time on each phone
3. An Android app cannot run on iPhone, Blackberry, PC, Mac, or Linux box
4. Difficult to manage updates
5. User must intervene to get latest versions
6. Newer (esp. Android)

So, fewer established tools and methodologies On the other hand, Android programming is similar to desktop Java programming, and there are plenty of established approaches there

Section V

Many application were involved mainly the data transfer. In the fig 1 different types of advantages are grouped together.

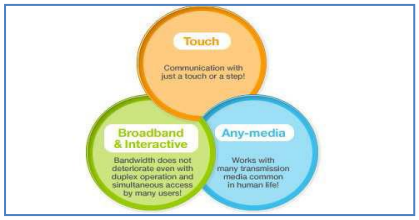

Fig. 1

Various technologies or devices will be modified with the system as follows:

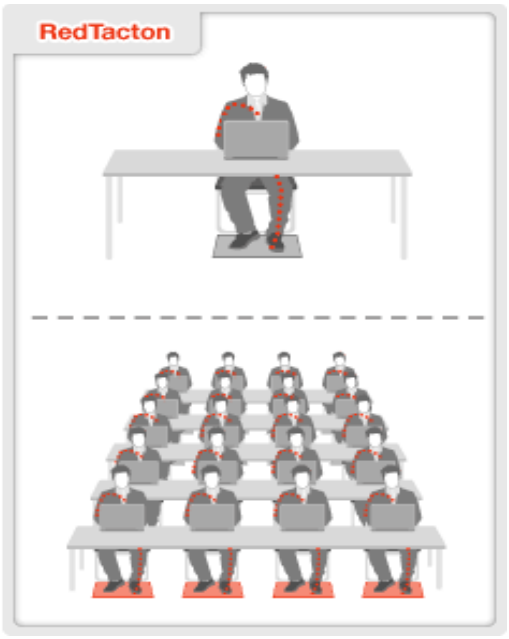

Fig. 2

In fig. 2 as shown there is chip below the legs of person and they all are accessing internet without any wires or modems.

Fig 3 touch to print

If a printer is installed with the software then a person can just touch a printer simultaneously touching a device in which a file to be print is there and a printing can be done. So many devices can be handled with just one touch so one need not carry any transfer media.

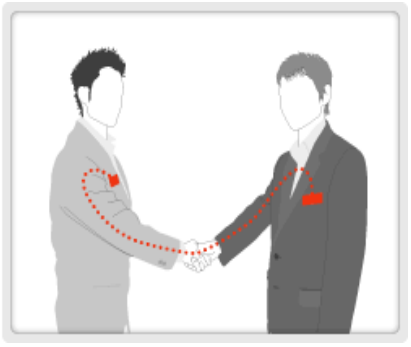

Fig 4 Data transfer with shake hand

Imagine one scenario that in conference or business meeting. We will share our visiting card or some personal information with some authentication with just a hand shake with person. It is mandatory that all are carrying a device i.e. mobile with them. It is explained as in fig 4. The data is transferred within fraction.

Fig. 5 Connection in conference

In a conference all the systems are interconnected with red tacton chip and data from chair person can be shared with all. In fig 5 it is shown that all red tacton chips are connected and all members will keep their system on the chip. And it is connected now biologically.

Section VI

This technology brings a new dimension of communication which effectively links the user to anyone he wants to communicate. Red Tacton technology is expected to dominate Bluetooth technology in the future. Red Tacton technology could put the use of cables to an end.

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