

# Touch and Play

Transferring data through human body

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## ABSTRACT

**All the user-friendly services require technologies that enable communication between people and objects in close proximity. This paper presents a novel intrabody communication system, in which communication between mobile terminals take place through human body. Human body is act as communication medium between mobile terminals. The technology that enables communication by touching, a technology we call RedTacton.**

**Intrabody Communication (IBC) is a novel non-RF wireless data communication technique which uses the human body itself as transmission medium for electrical signals. Because of Intrabody Communications (IBC) is a novel non-RF wireless data communication technique, it has low transmission power below 1mW and data rates of more than 100 kbps. This technology was developed by NTT, Japan. It uses minute electric field generated by human body as medium for transmitting the data. The device will be able to send/accept the data in digital format on Touch, as in when we touch the computer the printer will print the respective file.**

**Keywords:** *Embedded system, Communication through Touch Technology, ARM microcontroller, Android application.*

## I. INTRODUCTION

Intrabody communication (IBC) is a new innovative Human Area Networking technology that turns the surface of the human body as a safe, high speed network transmission path. IBC takes a different technical approach. Instead of relying on electromagnetic waves or light waves to carry data, IBC uses weak electric fields on the surface of the body as a transmission medium. Using intrabody communication system starts when terminals carried by the user or embedded in devices are linked in various combinations according to the user's natural, physical movements. Communication is possible using any body surfaces, such as the hands, fingers, arms, feet, face, legs or toes. IBC works through shoes and clothing as well.

Technically, it is completely distinct from wireless

and infrared. A transmission path is formed automatically when a person comes into contact with a device and communication between mobile terminals begins. IBC transmitter couples with extremely weak electric fields on the surface of the body. The weak electric fields pass through the body to a IBC receiver, where the weak electric signal amplify by amplifier to recover original electric strength signal. Then the recovered signal pass through microcontroller to the final stage.

## II. BACKGROUND OVERVIEW

### A. Existing Systems

- *Bluetooth*

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength radio transmissions in the ISM band from 2400–2480 MHz) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Created by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.

Bluetooth operates in the range of 2400–2483.5 MHz (including guard bands). This is in the globally unlicensed Industrial, Scientific and Medical (ISM) 2.4 GHz short-range radio frequency band. Bluetooth uses a radio technology called frequency-hopping spread spectrum. The transmitted data is divided into packets and each packet is transmitted on one of the 79 designated Bluetooth channels. Each channel has a bandwidth of 1 MHz. The first channel starts at 2402 MHz and continues up to 2480 MHz in 1 MHz steps.

Bluetooth is a packet-based protocol with a master-slave structure. One master may communicate with up to 7 slaves in a piconet; all devices share the master's clock. Packet exchange is based on the basic clock, defined by the master, which ticks at 312.5  $\mu$ s intervals. Two clock ticks make up a slot of 625  $\mu$ s; two slots make up a slot pair of 1250  $\mu$ s. In the simple case of single-slot packets the master transmits in even slots and receives in odd slots; the slave, conversely, receives in even slots and transmits in odd slots. Packets may be 1, 3 or 5 slots long but in all cases the master transmit will begin in even slots and the slave transmit in odd slots.

Bluetooth provides a secure way to connect and exchange information between devices such as faxes, mobile phones,

telephones, laptops, personal computers, printers, Global Positioning System (GPS) receivers, digital cameras, and video game consoles. It was principally designed as a low-bandwidth technology.

- *Infrared*

Infrared (IR) light is electromagnetic radiation with longer wavelengths than those of visible light, extending from the nominal red edge of the visible spectrum at 700 nanometers (nm) to 1 mm. This range of wavelengths corresponds to a frequency range of approximately 430 THz down to 300 GHz, and includes most of the thermal radiation emitted by objects near room temperature. Infrared light is emitted or absorbed by molecules when they change their rotational-vibrational movements. The existence of infrared radiation was first discovered in 1800 by astronomer William Herschel.

Slightly more than half of the energy from the Sun arrives on Earth in the form of infrared radiation. The balance between absorbed and emitted infrared radiation has a critical effect on Earth's climate.

Infrared energy elicits vibrational modes in a molecule through a change in the dipole moment, making it a useful frequency range for study of these energy states for molecules of the proper symmetry. Infrared spectroscopy examines absorption and transmission of photons in the infrared energy range.

- *Wi-Fi*

Wi-Fi, also spelled Wifi or Wi-Fi, is a popular technology that allows an electronic device to exchange data or connect to the internet wirelessly using radio waves. The Wi-Fi Alliance defines Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards". However, since most modern WLANs are based on these standards, the term "Wi-Fi" is used in general English as a synonym for "WLAN". Only Wi-Fi products that complete Wi-Fi Alliance interoperability certification testing successfully may use the "Wi-Fi CERTIFIED" trademark.

Many devices can use Wi-Fi e.g. personal computers, video-game consoles, smart phones, some digital cameras, tablet computers and digital audio players. These can connect to a network resource such as the Internet via a wireless network access point. Such an access point (or hotspot) has a range of about 20 meters (65 feet) indoors and a greater range outdoors. Hotspot coverage can comprise an area as small as a single room with walls that block radio waves, or as large as many square miles achieved by using multiple overlapping access points.

Wi-Fi can be less secure than wired connections (such as Ethernet) because an intruder does not need a physical connection. Web pages that use SSL are secure but unencrypted internet access can easily be detected by intruders. Because of this, Wi-Fi has adopted various encryption technologies. The early encryption WEP, proved easy to break. Higher quality protocols (WPA, WPA2) were added later. An optional feature added in 2007, called Wi-Fi Protected Setup (WPS), and had a

serious flaw that allowed an attacker to recover the router's password. The Wi-Fi Alliance has since updated its test plan and certification program to ensure all newly certified devices resist attacks.

To connect to a Wi-Fi LAN, a computer has to be equipped with a wireless network interface controller. The combination of computer and interface controller is called a *station*. All stations share a single radio frequency communication channel. Transmissions on this channel are received by all stations within range. The hardware does not signal the user that the transmission was delivered and is therefore called a best-effort delivery mechanism. A carrier wave is used to transmit the data in packets, referred to as "Ethernet frames". Each station is constantly tuned in on the radio frequency communication channel to pick up available communication.

### B. Drawbacks of existing system

- The existing systems based on radio frequency (RF) communication, so major drawback of wireless RF propagation is high power consumption which limit practical duration of operation.
- The key issue with RF propagation in portable devices is that it consume battery life quickly which result into limited practical duration of operation and wireless RF propagation is not too much secure.

### C. Proposed System

Intrabody communication is a Human Area Networking technology, which is under development that uses the surface of the human body as a safe, high speed network transmission path. It is completely distinct from wireless and infrared technologies as it uses the minute electric field emitted on the surface of the human body.

A transmission path is formed at the moment a part of the human body comes in contact with a IBC transceiver. Communication is possible using anybody surfaces, such as the hands, fingers, arms, feet, face, legs or torso. IBC works through shoes and clothing as well. When the physical contact gets separated, the communication is ended.

IBC has three main functional features:

- 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.
- Broadband and Interactive - Duplex, interactive communication is possible at a maximum speed of 10Mbit/s. 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.
- 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

### III. THE PROPOSED SYSTEM

#### A. System Overview

The proposed system will be divided into the following sections

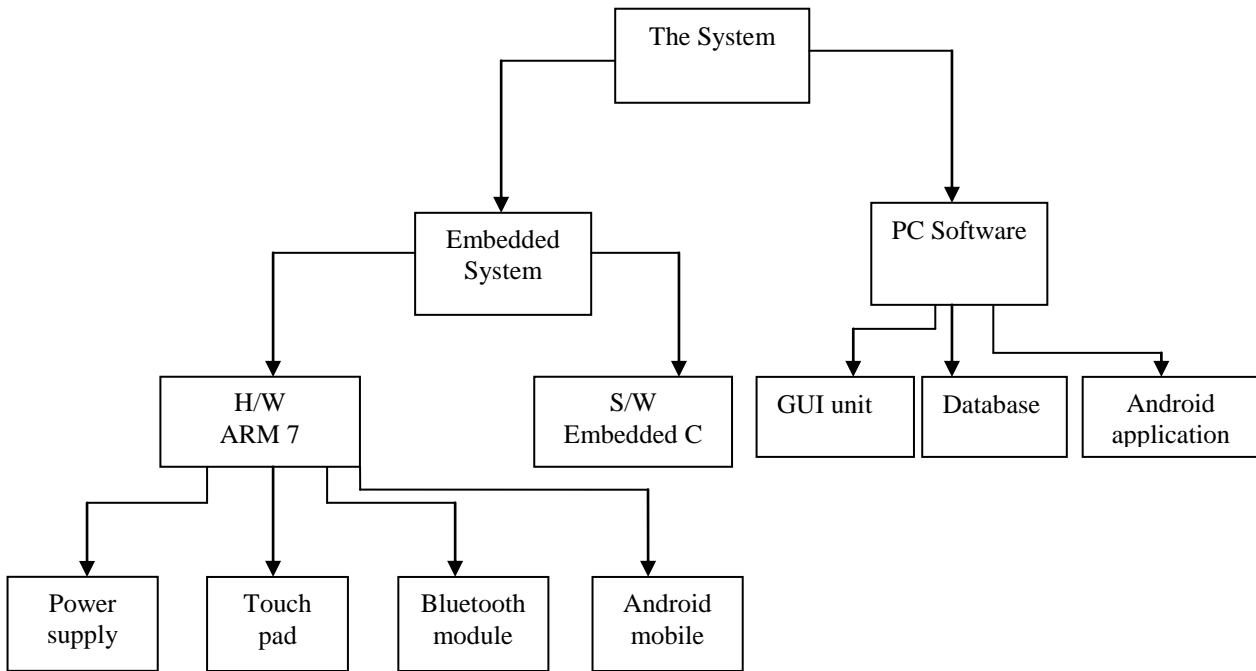


Fig. 1- System overview

#### B. Block Diagram

The Block Diagram of the system is given below.

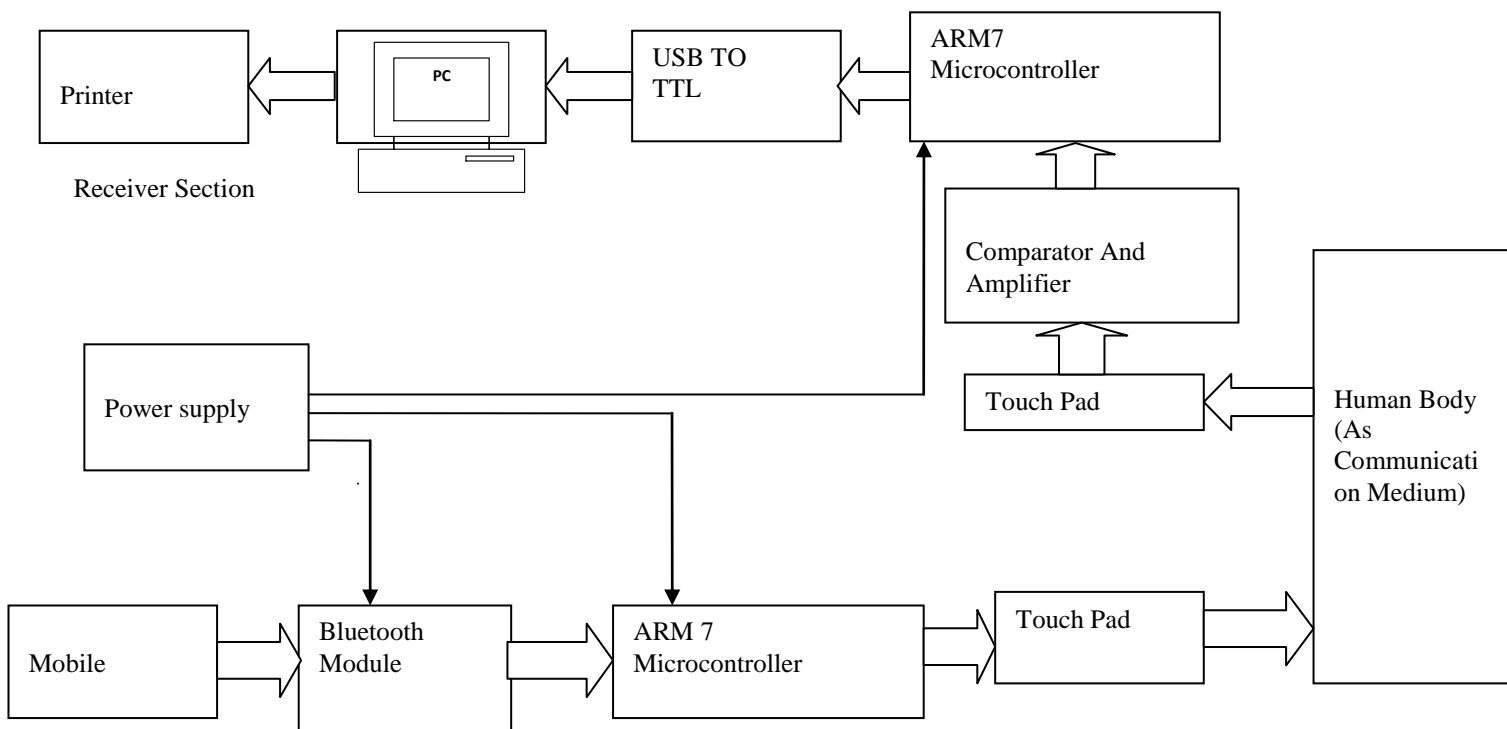


Fig.2-block diagram of touch and play system

### C. Working Principle

The following are the brief explanations of the working principle of the various major blocks or sections used in the system.

- **Power Supply**

An ARM microcontroller need 5V DC voltage. Whereas operating voltage of Bluetooth module is 3.3V. Power supply will be consists of transformer, rectifier, filter and regulator. The rectifier used here will be Bridge Rectifier. It will convert 230V AC into desired DC voltage.

- **Transmitter section**

Transmitter section consist of mobile phone, microcontroller, Bluetooth module and touch pad.

- **Microcontroller**

This is the heart of the complete system. Here ARM microcontroller is used. It has in build ADC. The input data(text file) from mobile received by ARM microcontroller through Bluetooth module. This data then transmitted to touch pad. The code will be written in Embedded C and will be burned or programmed into the code memory using a programmer. Microcontroller requires +5VDC for it proper operation.

- **Bluetooth Module**

The mobile will send the data to android microcontroller by using Bluetooth module. Here HC-05 Bluetooth module is used. It makes good serial communication with ARM microcontroller. . This unit requires +3.3V DC for it proper operation. This unit is connected to port D of the microcontroller.

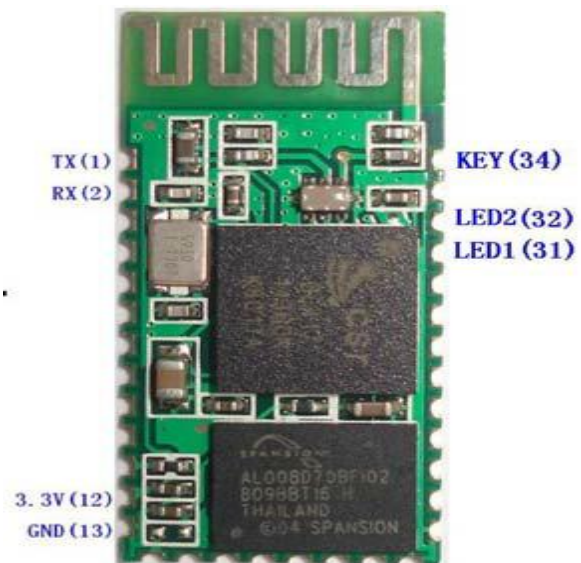


Fig.3-Bluetooth Module

- **Touch pad**

A touch pad is a type of switch that only has to be touched by an object to operate. It is used in many lamps and wall switches that have a metal exterior as well as on public computer terminals.

- **Receiver Section**

Receiver section consist of microcontroller, touch pad, amplifier and comparator, PC, printer and USB to TTL converter.

The signal received from transmitter side become weak, because this signal propagated through human body. So its need to amplify the signal by an amplifier and then given to microcontroller.

Microcontroller transmit appropriate signal(Text file) to PC for printing.

- **USB to TTL**

. A USB adapter is a type of protocol converter which is used for converting USB data signals to and from other communications standards. Commonly, USB adaptors are used to convert USB data to standard serial port data and vice versa.

### D. Technology & Programming Languages

Nowadays there is increasing demand for embedded technologies in all trends. The technology used here is embedded technology which is the future of today's modern electronics. Here this research includes combination of hardware and software.

The followings are the various Programming Languages & technologies used in the proposed system.

*For Embedded System*

- Embedded Technology
- ARM Based Controller,
- Embedded C programming,
- Protest Software for PCB Designing,
- Dip Trace for PCB layout

*For PC System*

- VB.net 2008 Based Application Software,
- File Handling,
- Serial Communication Protocol,

*E. Steps for project development*

The following are the steps for creating such a system

- Defining the Problem,
- Understanding the Need & Usability in real life,
- Developing Block Diagram,
- Designing Circuits of individual blocks,
- Testing circuits in LAB & Finalizing,
- Developing PCB on PC,
- Getting the PCB printed from market,
- Soldering the components,
- Performing various Basic Experiments to test the PCBs,
- Developing Flowchart for the entire process,
- Writing actual Software Program,
- Compilation & Burning,
- Testing and Debugging,
- Developing Flowchart for Android Side Software,
- Developing Data Flow Diagram,
- Writing actual code.
- Finally running the system and Documentation.

*F. Design Flow Diagram*

- DFD level 0

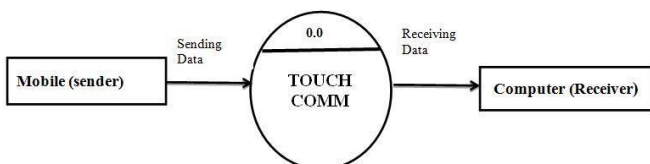


Fig. 4- Data Passing Through Human Body

In above DFD level0 fig.4 mobile is sender which is going to send an actual data. The TOUCH COMM includes sender and receiver side hardware. When the data is send by the mobile it gets pass through human body and then receiver will receives the data .After that data will display on the computer screen.

- DFD level 1

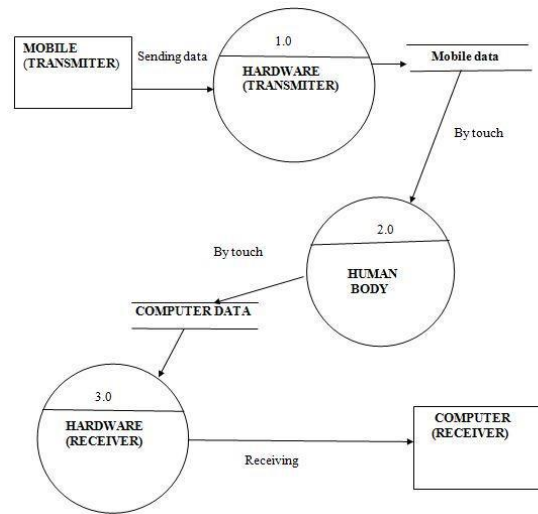


Fig .5- DFD level 1

The DFD level1 fig.5 shows that mobile send the data to the sender side hardware through Bluetooth. Now Human will touch the sender side hardware and then data will transfer through the human body. At the receiver side, by touching the hardware, using USB cable, then data will transfer to the computer

- DFD level 2

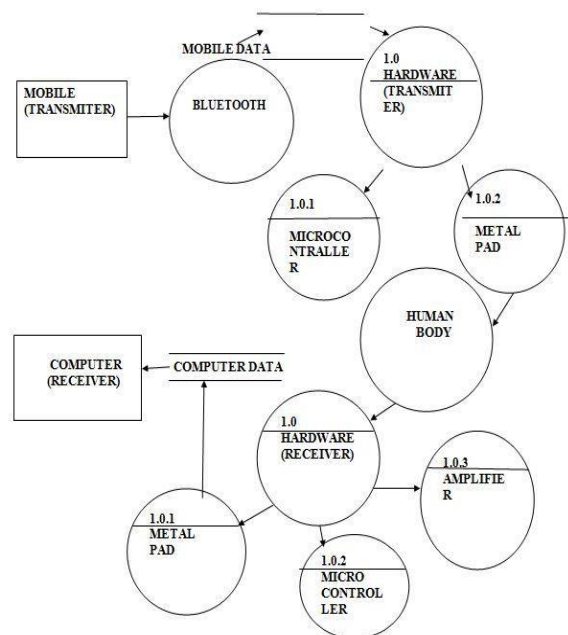


Fig 6- DFD level 2

The DFD level2 fig.6 shows that mobile send the data to the sender side hardware through Bluetooth. Now Human will touch the sender side hardware and then data will transfer through the human body. At the receiver side, by touching the hardware, using USB cable, then data will transfer to the computer.

#### IV. APPLICATIONS & ADVANTAGES

- Touch printing
- Door locking
- Conferencing
- Wireless headsets

- Security: This system is a protected and private communication network which provides natural security and interference-free communication.
- Energy consumption: IBC consumes an order of magnitude less energy (0.24nJ/b) at data rates up to 10 Mb/s.

#### V. CONCLUSION

This application is focused on improving the human computer interaction. Since the next level of interaction will be touch, we believe that this project is a major improvement in this field. The main advantage of the project is that it does not use any radio waves at all for data transmission. Over usage of radio frequency is a major concern these days. We believe that the project made us learn technologies and broadened our horizon to a large extent. While the system presented here has limitations these can be overcome and the system can be implemented in day to day activities.

#### VI. FUTURE WORK

The application can be studied and a lot of work can be done based on the prototype. In the future it can change the way humans interact with computer. For example just by touch you can exchange business cards between two individuals.



Fig.7 - Touch printing

Enter your personal details in any application just by touching the touchpad. Human computer interaction will change dramatically when this technology will be used.

The data transmission being the prime applications of TouchComm. The other important applications in the future would be: keyless door entry, touch printing, wireless headset, end of smart cards as human touch would replace smart cards.

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