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INTRABODY COMMUNICATION IN BIOMEDICAL APPLICATIONS

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ABSTRACT

Now-a-days new technologies are introduced to make communication more feasible. Red tacton is one of the communication technology which uses body as a medium. Red tacton communication is done in three ways like body to body, object to object and body to object. In biomedical applications it is helpful in the patient monitoring. Using red tacton the data can also transferred in wood, cloth and water. The data can be transferred between the bodies depend on the area or distance. In usual patient monitoring systems the cables are connected to the body and it makes uncomfortable. In this red tacton there is no use of any cable requirements. It is easy, simple and fast execution.

KEYWORDS—Data Transmission, Light Emitting Diode, remote patient monitoring, redtactontx and rx

1.INTRODUCTION

Now-a-days technologies made communication more feasible. Communications are of two types. They are interbody communication and intra body communication. Human body is used as a transmission medium in intra body communication. Human body acts as both transmitter and receiver by placing electrodes in different locations on the body. Hence, it will come under galvanic body coupling. Red tacton was announced by the NTT Labs from Japan in 2005. When the signals are transmitted, the collisions will occur less at receiver side.

Red tacton is a unidirectional, high speed and fully network wireless communication technology. It can be used in any mode of transmission like Bluetooth, zigbee, Wi-Fi and wireless body area network (WBAN). The minute electric field present in body acts as a communication in galvanic body coupling which converts ac to dc signal. The 16F877A pic microcontroller is a self programmable device. The power consumption is less. Coding and decoding can be done n number of times. Various sensors are

interfaced directly to the controller without help of external devices. USART serial port communication is used at receiver side to receive the data.

2. RELATED WORK

Many networks were introduced like Bluetooth, zigbee, wireless sensor networks etc. The new technology is induced called wireless body area network. Their build resistivity present in body used in communications was introduced in the middle of many company were worked on concept. MIT introduced body as interface research on position sensors. A wearable key prototype was introduced by the Sony labs by using similar technology. Many implements and future work carried out results in the success of the companies like NNT (Nippon Telegraph and Telephone), KAIST (Korea Advanced Institute of Science and Technology), SSL (Semiconductor System Lab) etc.

3. RED TACTON

Red tacton is a new technology for body communication. Red tacton is a warm colour according to Japanese culture and tacton refers to action triggered by touching. It uses the minute electric field which is present on the surface of the body. The speed of data transmission is 10mbps on surface of the skin and safe execution. In red tacton, the input is both analog and digital signal. In bio medical applications the input signal is analog and it is interfaced with controller which is having inbuilt ADC. Hence, at the receiver side the output is digital. It is a point to point communication. Communication terminals are face, leg trousers, arms etc. It is helpful in listening music like mp3. When the person went for a walk, the data can be transmitted through the clothes to the headphones, so that the person can listen the music and the same application can be seen in the personal computer like viewing of images.

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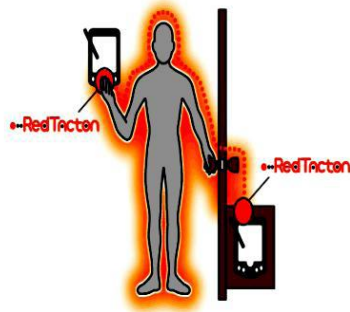


Figure 1. The red tacton

4. BODY COUPLE COMMUNICATION TECHNOLOGIES

In body coupled communications human body acts as communication channel. This approach can be done in two ways are

1. capacitive body coupling
2. galvanic body couplings

These two types of coupling is conducted by using of the electrodes. In the galvanic body coupling the electrodes are placed on the skin. Without carrying of electrodes the communication is possible in the capacitive body coupling. Comparing with these two types always prefers to the galvanic body coupling.

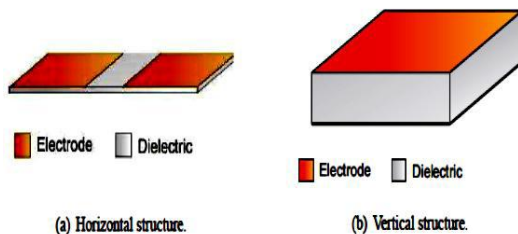


Figure 2. coupler structures

The coupling can be defined by placing the electrodes in horizontal or in vertical directions. In capacitive the electrodes are oriented or shifted because they were placed in the transverse medium. Whereas for the galvanic the electrodes are placed in the horizontal manner and feasibly for the communications. The arrangements are shown in the below diagram.



Figure 3. Different orientations for horizontal coupling

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1. CAPACITIVE BODY COUPLING

In this the transmitter and receiver electrodes are placed on the body. The transmitting electrode is use a single electrode placed on the body acts as a reference electrode. The receiver will be having of two electrodes placed at different locations and can be compared the results.

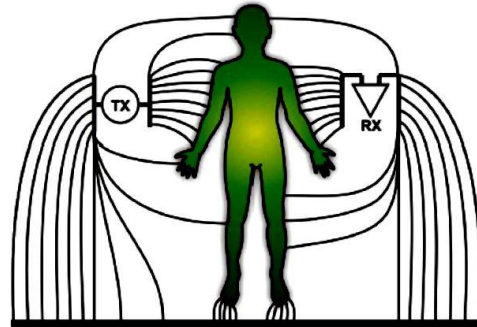


Figure 4. capacitive body coupling for data transmission and tx and rx.

GALVANIC BODY COUPLING

The transmitter and receiver are having different electrodes that are placed in various locations on the body. The transmitter will be having the update values and stored at the transmitter side. At the receiver side the received data can be transferred only when it came in contact with the transmitter through electrodes and human body act as a medium.

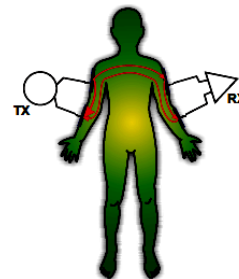


Figure 4. Galvanic body coupling for data transmission between transmitter and receiver.

LCD

LCD is known as liquid crystal display. It is a 16X2 bit. It has eight data pins. The supplies are VSS, VDD, VEE. In the vss is given as the power supply. Whereas vdd is given as ground and vee is connected to the potentiometer. With the help of the potentiometer the brightness is adjusted. It also having RS, RW and EN pins. EN pin is known as the enable. RS is known for the command or data pins. RW is referred as the read or the write commands. Based on the commands the outputs are displayed in the LCD.

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SENSORS

Device is used to convert physical signal to electrical signal. There are different types of sensors available in communication. Based on the requirements different sensors are used in communication. ECG Sensor, respiratory sensor, blood pressure sensor, blood glucose sensor are the sensors which are implementing in our project.

1) ECG Sensor

It is known as electrocardiography. It has three electrodes. Combination of one systole and one diastole is known as heart rate. They are right arm, left arm and the other electrode is reference electrode. The reference is carried out by the other person. It shows the output as pulse rate. The normal human body pulse rate should be less than 270. For a dead person it will show 270. The heart rate can be calculated by using PQRSTU wave form. The heart rates are of three types. They are heart rate, inter beat interval and heart rate variability.

2) RESPIRATORY SENSOR

Respiratory sensor is used to calculate the number of beats per second. These sensors are of two types. They are in the form of mask and belt type. Belt type is placed below the abdomen or chest accordingly values are recorded. Where as in mask type it is placed near mouth according to the respiration the beat values are measured. By using this sensor we are detecting sleep apnea. Sleep apnea are of two types.

- 1) Objective sleep apnea
- 2) Central sleep apnea.
- 3) Mixed sleep apnea.

Objective sleep apnea is very common in adults. Main reasons for OSA are over weight, hereditary and large tonsils. CSA is mainly caused by consumption of alcohol, smoking and sudden weight loss. CSA in German is known as ONDINE'S CURSE which means person who forgot to breathe.

3) BLOOD PRESSURE

The normal rate of blood pressure is 120/80 mmHg of Hg. Blood pressure is calculated with the help of systolic and diastolic values. If any variations occur in this range it leads to disorders. There are two types of blood pressures are

- 1) High blood pressure
- 2) Low blood pressure

For high normal blood pressure the systolic and diastolic values ranges from 130 and 80-89. High

blood pressure takes place in two stages. Stage one is hyper tension, the systolic ranges from 140-159 and diastolic ranges from 90-99. Stage two hyper tension, the systolic value is 160 and diastolic is 100. The blood pressure in arteries is known as systolic or simply known as contraction. The relaxation of the heart is known as diastole. It increases with increase in age which results in stiffening arteries.

In the case of high blood pressure leads to the heart stroke or sometimes it leads to the death of the person. The person suffering from the low blood pressure may faints for some time.

4) BLOOD GLUCOSE

Blood glucose test is carried to check the levels of the sucrose level in the body. The normal rate is 4.4 to 6.1 mmol/L or 99 to 110 mg/L. The diabetes are classified in to three types. They are

- 1) Type 1 diabetic
- 2) Type 2 diabetic

The both values are differ during walking. The sugar level of the diabetic patient before meals varies from 4-7 mmol/L. After meals the value is 9 mmol/L.

IV. CONSTRUCTION AND WORKING

PIC microcontroller is an embedded controller. It has 40 pins. 33 pins are used as I/O pins. It uses the flash memory. So, the programming can be writing and erase as many times as possible. It has five ports. Coding is dubbed at port C. It is 8 bit and used for analog. The sensors are interfaced with PIC micro controller. The crystal frequency is 10000 UF. The step down transformer of 230V is used as power supply and connected to the bridge rectifier converts AC to DC supply at 12V. The IC7805 voltage regulator is used to convert constant power supply of 5V which is given as input power supply to the PIC micro controller. Red tacton transmitter is interfaced at port C in microcontroller and electrode is placed on human body. UART is interfaced with PC at the receiver side of the red tacton receiver. The sensors outputs are displays in the PC.

The PIC microcontroller uses the embedded C software and MPLAB IDE. These are the two possible software for programming. It has many additional features compared to the other coding languages. In this as number of times the coding and decoding is possible. In this first we declare the global interrupts and for transmitting and receiving the data. Additional declarations for the sensors as input and display the outputs in the LCD. The brightness of the liquid crystal display can be adjusted by using the potentiometer.

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BLOCK DIAGRAM

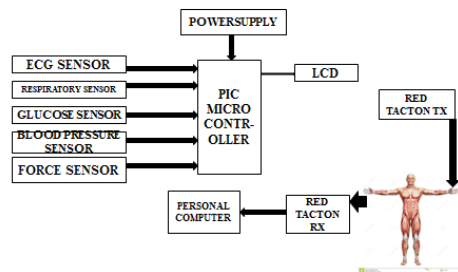


Figure 2. block diagram

RED TACTON TRANSCIEVER

The figure3 is the block diagram for transmitter and the receiver. For the transmitting side the data is updated and stores in the transmitter. When it is in contact with receiver the data can be transferred.

The major tools in the communication are transmitter, receiver and pic micro controller. When the data is transmitting in the LCD, it display "transmitting" on the screen. The transmitted data displays in the pc.

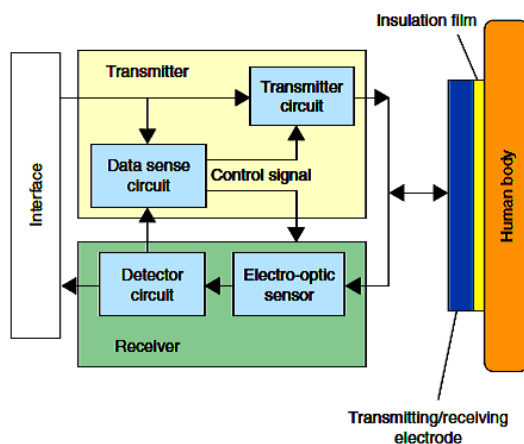


Figure 3. red tacton transceiver

EMBEDDED C

This is the heart of the pic microcontrollers coding. it is very simple and easy to execute. it has many advanced features and applications compared to other programming languages. with the help of embedded c various languages can be implemented for the better resolution and efficiency like neovuton, arduino boards etc. It is used to execution for serial ports, input and output operations.

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MP LAB

It is the combination of both software tools and hardware tools. possible ways for programming in microcontroller are embedded c and mp lab ide. initially we have to assign global interrupts. the coding is similar with c language. mp lab ide is known as microprocessor chip mp lab ide. it is advance version of implementation of process in microchips. it is developed by microchip technology. for 8 bit, 16 bit, 32 bit can be editing, debugging and management can be done easily. It also developed in other software domains like OS, linux and windows etc. the latest version is mp lab x. it was developed by net beans using oracle version.

V. APPLICATIONS

SECURITY APPLICATIONS

It is mainly helpful in the atm machines are being robbed. In this the pin or the data can be given directly instead of manual. For the securing the red tacton transmitter can be safeguard by using fingerprints for verification.

MILLITARY

In the military applications during the war, a soldier having a Red Tacton authenticated gun is supposed to fire with that respective gun. Nobody soldier can use that gun for firing if that authenticated soldier is dead or not able to participate in the war. It gives advantages that enemy soldier cannot attack the other party with their own ammunitions.

MARKETING APPLICATIONS

For example in malls the customers stand in front of the advertising panel where the things are displayed automatically. If they are interested in any products, with the touch they will get the details of the product.

PERSONALISATION OF AUTOMOBILES

In driving cases, the driver feel difficulty in adjusting of steering and seat position. If the person wants to listen music with the help of the touch he can play the music. It is also helpful in mobile applications like billing, commences and call history.

VI. CONCLUSION

For intra body communication we are using red tacton because it is easy to execute. It is safe and secure. It can be used in any field based on our requirements. In the biomedical applications for taking of various tests to single person it requires single person to execute and it does not required many people and it also a wireless communication.

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