Intra-Body Communication in Biomedical Applications

Athira. A, Ajeena. A, Athulya Raveendran and Vasanthapriya. L
Dhanalakshmi Srinivasan Engineering College,
Perambalur, Trichy

***Abstract*:- The project presents a new concept of communication method called as Intra-body communication in biomedical field. Human body is used as a medium of transmission of data. The use of this technology in medical monitoring systems eliminates the complexity of existing technologies that involves cables, wires for transmission of data. The proposed model provides a secure and simple communication system that consists of wearable devices to measure respiration, BMI, and GSR transmits the data to the master device in real time. The model, wearable on wrist or any other part of the body has an integrated and an insulating material (copper) to allow the intra-body communication using the method of galvanic coupling. Thus the proposed methodology of using human body enhances the security of transmitted signals as compared to the other wireless technologies.**

I.INTRODUCTION

In every individual's life, today health care market has become one of the important issues. New technologies and various instruments are been developed to improve the monitoring systems. Diagnosis and treatment are majorly dependent on monitoring information. Existing systems uses cables and wires to measure health related parameters like temperature, blood pressure, heart rate, etc. this makes the patient very uncomfortable and immovable. This especially increases the complexity in case of long term emergency and risk patients. The monitoring devices receive data through sensors. [1].Various sensors are emerging to monitor Electrocardiogram (ECG), body temperature, pulse oximetry (Sp02), electroencephalography (EEG) and blood pressure for monitoring of emergency and risk patients. Till date, existing system uses wired technology to interconnect between sensors and monitoring systems. This makes the patient feel uncomfortable and unable to move freely. The aim is to reduce the complexity by replacing wired network with wireless technology. Wireless technologies such as WLAN, Bluetooth, etc. will make the patients free, mobile and comfortable.

This also simplifies complex surgical and medical treatment monitoring and database can be generated and stored. The capacity of a single sensor to generate data is small in the range of few Kbit/s for monitoring of biological signals. A very huge number of sensors are required to enhance the data rate to few hundreds to thousands of Kbit/s [1]. Existing systems uses cables and wires to measure health related parameters like temperature, blood pressure, heart rate, etc. this makes the patient very uncomfortable and immovable. Till date, existing system uses wired technology to interconnect between sensors and monitoring systems. This makes the patient feel uncomfortable and unable to move freely.

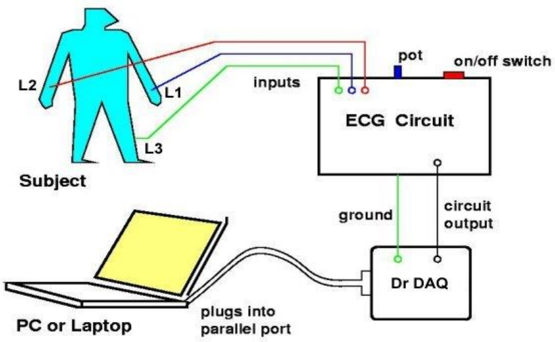

Fig1: Existing block diagram

II PROPOSED MODEL

The proposed model block diagram is shown. It is mainly built on the PIC16F877A Microcontroller. Respiration sensor used to sense respiration level. BMI is a “BODY MASS INDEX”. Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI is a reliable indicator of body fatness for people, GSR stands for galvanic skin response, is a method of measuring the electrical conductance of the skin. Strong emotion can cause stimulus to your sympathetic nervous system, resulting more sweat being secreted by the sweat glands. The proposed system consists of three devices namely Respiration, BMI, GSR, and wireless transcei

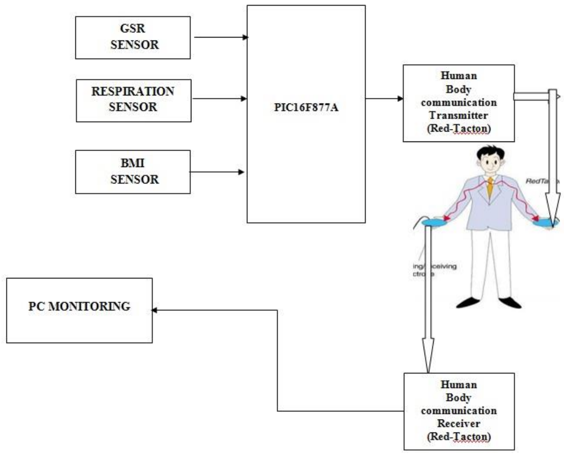

Fig2: Proposed block diagram

III. GENERAL DESCRIPTION

BMI SENSOR

BMI is a "BODY MASS INDEX". Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI is a reliable indicator of body fatness for people. BMI does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat. BMI is used as a screening tool to identify possible weight problems for adults. Body fat serves a vital role in storing energy and protecting internal organs. Also, the distribution of body fat in men and women is different, so the basis for classifying the body fat percentage is different between the genders.

The BMI160 is a small, low power, low noise 16-bit inertial measurement unit designed for use in mobile applications like augmented reality or indoor navigation which require highly accurate, real-time sensor data. In full operation mode, with the accelerometer and gyroscope enabled, the current consumption is typically 950 µA, enabling always-on applications in battery driven devices. It is available in a compact 14-pin 2.5 x 3.0 x 0.8 mm³ LGA package." The BMI160 is also equipped with an integrated 1024 byte FIFO buffer that supports low-power applications and prevents data loss in non-real-time systems. The IMU offers a wide supply voltage (VDD) range from 1.7V to 3.6V, a flexible digital primary

The body mass index (BMI) or Quetelet index is a value derived from the mass (weight) and height of an individual. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m2, resulting from mass in kilograms and height in metres.

The BMI may also be determined using a table[note 1] or chart which displays BMI as a function of mass and height using contour lines or colours for different BMI categories, and which may use other units of measurement (converted to metric units for the calculation).

The BMI is an attempt to quantify the amount of tissue mass (muscle, fat, and bone) in an individual, and then categorize that person as underweight, normal weight, overweight, or obese based on that value. However, there is some debate about where on the BMI scale the dividing lines between categories should be placed.[1] Commonly accepted BMI ranges are underweight: under 18.5 kg/m2, normal weight: 18.5 to 25, overweight: 25 to 30, obese: over 30. People of Asian descent have different associations between BMI, percentage of body fat, and health risks than those of European descent, with a higher risk of type 2 diabetes and cardiovascular disease at BMIs lower than the WHO cut-off point for overweight, 25 kg/m2, although the cutoff for observed risk

FEATURES

- Input voltage: 5v
- Output voltage: 0-5v
- Output: Analog
- Centre measuring accuracy: ±5 mm

Minimum distance for metallic deflectors: 200mm

GSR SENSOR

The Galvanic Skin Response Sensor (GSR - Sweating) allows you to measure the electrical conductance of the skin. It acts as an indicator of psychological or physiological arousal. The conductivity of our skin changes according to unconscious emotion effects such as sudden noise, stress, touch, pain or view. The Galvanic Skin Response (GSR) sensor measures the conductivity of our skin, especially of our fingers. Simply by measuring the skin conductance (which is controlled by special part of our brain called sympathetic nervous system) we can spot and detect human emotions and stress. The higher the arousal, the higher the skin conductance It is noteworthy to mention that both positive ("happy" or "joyful") and negative ("threatening" or "saddening") stimuli can result in an increase in arousal – and in an increase in skin conductance.

Skin conductance, also known as galvanic skin response (GSR) is a method of measuring the electrical conductance of the skin, which varies with its moisture level. This is of interest because the sweat glands are controlled by the sympathetic nervous system, so moments of strong emotion, change the electrical resistance of the skin. Skin conductance is used as an indication of psychological or physiological arousal; the device measures the electrical conductance between 2 points, and is essentially a type of ohmmeter. GSR allows you to spot such strong emotions by simple attaching two electrodes to two fingers on one hand.

REDTACTON

The implementation of easy-to-use ubiquitous services, Human Area Network Technology for communication has become important.

When cables are used for communication, routing these cables is clearly inconvenient. When very weak radio signals are used for communication, data speeds are reduced by packet collision and other such problems such as security risk from unwanted signal interception. Technology for solving such problems includes the use of the person's body as a signal path for communication. A transmission path is formed automatically when people come in contact with a device. The technology that uses the surface of human body as a safe, high speed network transmission path is called Human Area Network.

Red Tacton 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. Red Tacton can be used for intuitive operation of computer-based systems in daily life, temporary one-to-one private networks based on personal handshaking, device personalization, security, and a host of other applications based on new behavior patterns enabled by Red Tacton.

III.HARDWAREDESCRIPTION

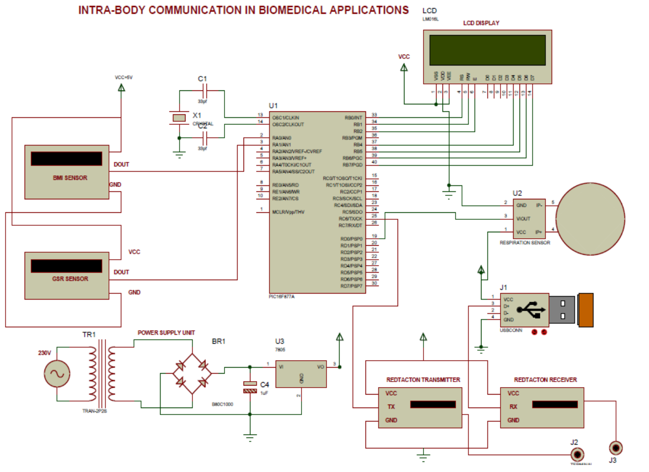

Fig3: Hardware connection

The PIC16F877A CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C5x, PIC12Cxxx and PIC16C7x devices. It features 200 ns instruction execution, 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.

BMI is a “BODY MASS INDEX”. Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI is a reliable indicator of body fatness for people. BMI does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat. BMI is used as a screening tool to identify possible weight problems for adults. Body fat serves a vital role in storing energy and protecting internal organs. Also, the distribution of body fat in men and women is different, so the basis for classifying the body fat percentage is different between the genders.The Respiration Sensor is used to monitor abdominal or thoracical breathing, in biofeedback applications such as stress management and relaxation training. Besides measuring breathing frequency, this sensor also gives you an indication of the relative depth of breathing. The Respiration Sensor for Nexus can be worn over clothing, although for best results we advise that there only be 1 or 2 layers of clothing between the sensor and the skin. The Respiration Sensor is usually placed in the abdominal area, with the central part of the sensor just above the navel.

Fig4: Proposed hardware

IV. CONCLUSION

This paper introduced a very recent technology of intra-body communication and its application in biomedical field. It is proved that body can act as an electrical channel for transmission of data. Several wearable devices communicate through human body. The system performs data communication between a master and slave devices. The prototype can be further miniaturized in the form of wrist watch and integrated with wearable devices or any other devices. This will reduce the complexity of using wires and cables for monitoring patients. The intra-body communication technique offers a more power efficient and also a secure short-range communication with less power consumption, compared to other wireless radio frequency technologies.

In future years, improvisation and advancement can be achieved in the various effects of motion of user on the quality of transmission, speed of transmission at different carriers and effect on health of the patient of long term treatment.

REFERENCES

[1] Joyanta Kumar Roy, Bansari Deb, Dip Chakraborty Satyajit Mahanta and Nairit Banik, “The Wearable Electronic Rescue System for Home Alone Elderly- Labview & Arduino Evaluation,” IOSR-JECE, Volume 8, Issue 6 (Nov. - Dec. 2013), PP 50-55.

[2] N Natarajan, S Aparna and J Sam Jeba Kumar, “Patient Monitoring System Based on e-health Sensors and Web Services,” ECAI 2016 - International Conference – 8th Edition, July 2016.

[3] K. Subramanya, Vishnuprasada V. Bhat, and Sandeep Kamath, “A wearable device for monitoring galvanic skin response to accurately predict changes in blood pressure indexes and cardiovascular dynamics,” IEEE, Annual IEEE India Conference (INDICON)

[4] Salomi S. Thomas, “Sensing Heart beat and Body Temperature Digitally using Arduino,” SS – AAICSP – 10 – 01.

[5] Ming zher Poh,Picard,Non contact automatedcardiac pulse measurements usaing video imaging and blind sourse separation.Optical society of America,2010

[6] Pavli is,J.Dowd all, N. Sun,C.puri,J.Fei,and M.Garbey.Interacting with human physiology,Comput.V is,Image Underst.108(2014)

[7] S. COOK,M.C Schub,P.Wenaweser,and O.M.Hess,High heart rate:acardiovascular risk factor Eur.Heart J.27(2007)

[8] F.P.Wieringa,F.Mastik,and A.F Van der steen Contactless multiple wavelength photoplethysmographic imaging:a first step towards Spo2 camera technology, Ann.Bio med.33(2005)

[9] C. Takano,anfd Y.Ohta,Heart ratemeaurement based on a time lapse imaging,M ed.Eng Phy29(8),(2007)

[10] S.Hu,j,Zheng,V Chouliaris and R.Summers,Feasibility of imaging photoplethysmography,in Proceeding of IEEE(2010)

[11] T.Vishnu Kumar, V. Suresh Kumar, T. Sumeet, M.Srimaha "Hybrid Front end Interface DC-DC Converter with ANFIS Based Control of EMS System". International Journal of Scientific Research in Science and Technology, Volume 3, Issue 8, Print ISSN: 2395-6011, 2017.

[12] T. Vishnu kumar, V. Suresh Kumar, A new approach to front end interface DC-DC converter" International Journal of Multidisciplinary Research and Modern Education (IJMRME) ISSN(online): 2454-6119 Volume I, Issue II, 2015

[13] V.Suresh kumar, T. Vishnu kumar, A certain investigation for the battery charging system" International Journal of Multidisciplinary Research and Modern Education (IJMRME) ISSN(online): 2454-6119 Vol.1 Issue.1 2015.