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Signal Transmission By Galvanic Coupling Through The Human Body

Abstract

This project explores the possibility of using the human body as a medium for very low power communication. According to IEEE STD 1246-2002, the safe level of current that can flow through human body is 1mA. This project proposes to use currents of the order of a few µA to transmit signals from one part of the body to another.

This project can eliminate the use of conventional communication mediums like wires or air borne RF waves, or optical communication etc. Thus, effectively eliminating the various drawbacks or limitations associated with these conventional communication techniques. For human body communication electrodes similar to that of ECG electrodes will be used to for galvanic coupling of signals to the skin, from a transmitter circuit. Similarly on the receiving end electrodes will be used to extract the transmitted signal and process the signal through a receiver circuit.

In this project a source analog signal will be digitized using a ADC, and using a embedded system the ADC data will be galvanically coupled to the human body using electrodes. On the receiving side the transmitted digital signal will be extracted from the body using electrodes. While the signal is conducted through the body, it undergoes various distortions. This signal is then processed to reconstruct the transmitted digital signal. The reconstructed digital signal will then be converted back into the original analog signal again using a embedded system, with a DAC. Thus demonstrating the functioning of the human body communication system.

The source of the signal could be any small signal source like a sensor, or a audio signal depending on the application assumed for the project. If it is the transmission of biomedical signals, then sensors like Pulse Oxymetry, temperature or pressure can be used. If application to be demonstrated is entertainment or the usage of personal communication devices like mobile phones, then an audio signal can be used.
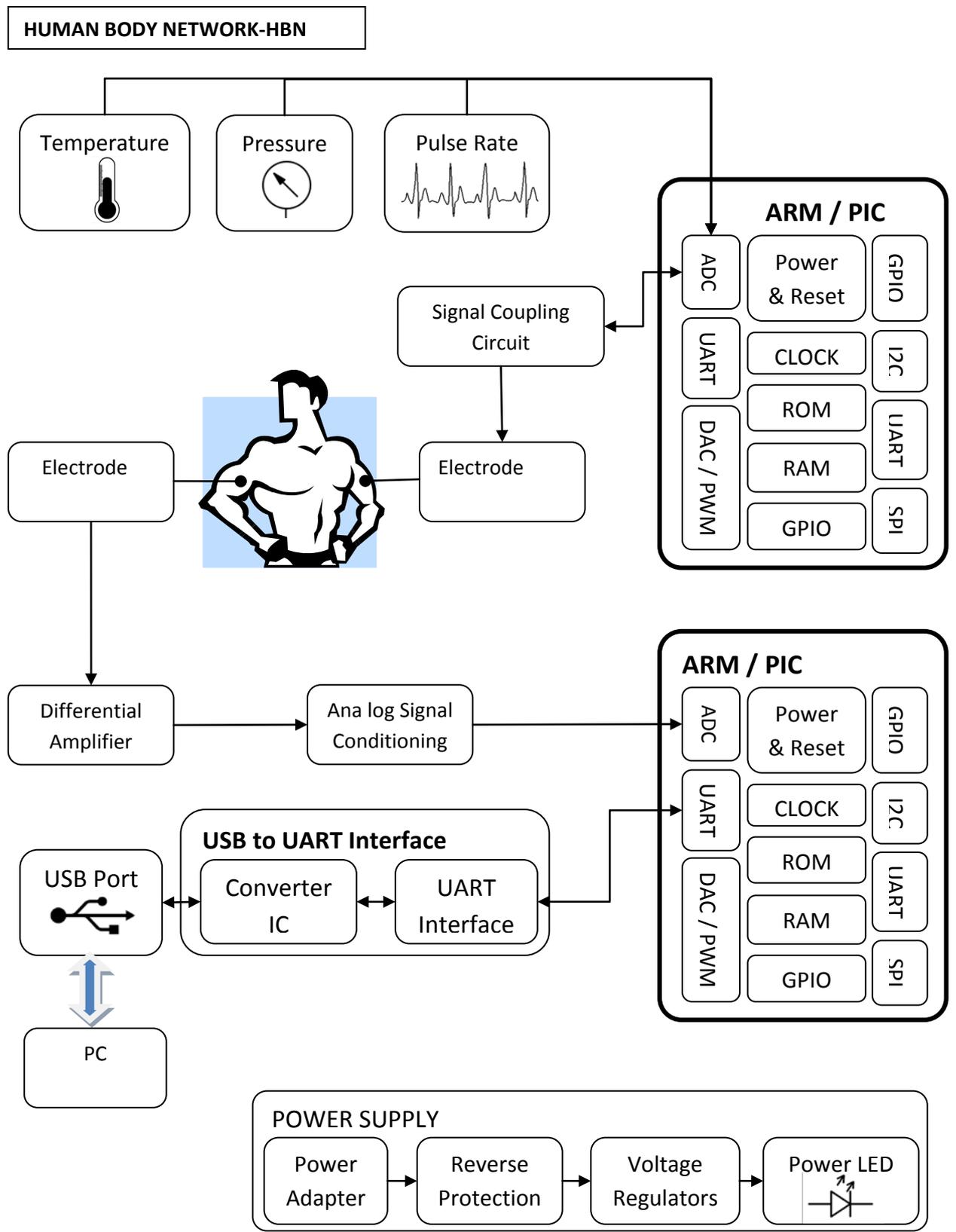
Existing System

1. Conventional communication technologies like wires or PAN (personal area network) technologies like Bluetooth are used for similar applications.
2. Wires are not always a convenient means of communication.
3. Bluetooth cannot be used for multiple applications like multiple transducers on a patient.
4. Bluetooth and similar technologies are relatively expensive and require RF signals.

Proposed System

1. Human body is a conductor in itself.If used as a conductor, it can eliminate the need for conventional wired and wireless communications.
2. Data from multiple parts of the body can be transmitted to one part of the body in case of biomedical applications, enabling easy monitoring.
3. Since this does not require RF transmission, it will be eventually low power than wireless technologies.

HUMAN BODY NETWORK-HBN

Temperature

Pressure

Pulse Rate

Signal Coupling Circuit

Electrode

Electrode

ARM / PIC

ADC

UART

DAC / PWM

Power & Reset

CLOCK

ROM

RAM

GPIO

GPIO

I2C

UART

SPI

Differential Amplifier

Ana log Signal Conditioning

ARM / PIC

ADC

UART

DAC / PWM

Power & Reset

CLOCK

ROM

RAM

GPIO

GPIO

I2C

UART

SPI

USB to UART Interface

USB Port

Converter IC

UART Interface

PC

POWER SUPPLY

Power Adapter

Reverse Protection

Voltage Regulators

Power LED

- MPALB IDE / LPC Ware IDE
- EAGLE
- Orcad
- Labview
- Embedded C

Hardware Required

- PIC18F45K22 / ARM LPC11U67
- Input transducers-Heart beat, Temperature ,Pressure sensors
- Display / Computer
- Electrodes
- Analog signal processing circuits