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RESEARCH ARTICLE

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AN UWB RADAR SIGNAL PROCESSING PLATFORM FOR REAL-TIME HUMAN RESPIRATORY FEATURE EXTRACTION

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ABSTRACT

This paper presents an ultra-wide band(UWB) impulse radar signal processing platform used to analyze human respiratory features .Conventional radar system used in human detection only analyze human respiratory rates or response of target. The modified raised cosine waveform (MRCW) respiration model and an iterative correlation search algorithm that could acquire additional respiratory features such as the inspiration and expiration speeds, respiration intensity, and respiration holding ratio. To realize real-time respiratory feature extraction by using UWB signal processing platform. The motivation of this project comes from the interest in using medical radar technology to monitor respiratory activities of human beings without direct skin contact. An advanced signal processing approaches are used to identify and to extract human vital signs in complex disaster environment by using Ultra wide band Transceivers. System not only detect whether the person is dead or alive and also gives the decision support for the diagnosis for treatment .The database for the victims are stored for further initial medical treatment before hospitalization. The objective of this project is to extract trapped victims in complex environmentally by using ultra-wide band radar and diagnosis injured persons by monitoring their heart beat and respiratory system without direct skin contact.

Kew Words-Biomedical measurement, biomedical signal processing, piecewise linear approximation, radar.

INTRODUCTION

Ultra-wideband (UWB) radar can provide high-resolution information regarding a scanned target because of its large bandwidth. Impulse-based UWB radar are particularly suitable for use in remote medical and human monitoring system because of their low-power radiation. Thus numerous researches have recently investigated human detection by using UWb radar system. The respiration rate is vital information for medical application such as sleep stage classification. Therefore extensive studies on medical UWB radar signal processing have focused on estimating the respiration rate.Fourier transformer and discrete wavelet transform are popular methods for analyzing respiration rates.Weiner-filter-based post signal processing method was presented to improve the resolution of respiration rates.In practice, respiration signals of inspiration and expiration contain additional information that can facilitate clinical diagnosis. Studies on UWb radar based human detection system had only explored respiration rate detection; Therefore a modified raised cosine waveform(MRCW) respiration model devising an iterative correlation search algorithm to acquire additional respiratory features such as the inspiration and expiration speeds, respiration intensity, and respiration holding ratio. These features, the parameter and compressed respiratory signals, can provide physical information to facilitate clinical diagnosis: thus the respiratory monitoring system can effectively manage the database because of decreased storage capacity and transmission power requirements. the respiratory feature extraction algorithm is computationally intensive. Further in addition to reducing hardware complexity another goal of this was achieving the real-time operation of the proposed radar digital signal processing (DSP) system. Therefore, this paper also proposes a new respiration model and applies an early termination scheme to modify various sampled values regarding the body movement. By sampling the reflected pulses, the radar front-end chip can capture the human respiration waveform. The rising slope corresponds to human expiration and the falling slope corresponds to human respiration. Design and implementation of the proposed human respiration expiration algorithm and system integration, and a transceiver chip was employed to capture the respiration signal in the practical wireless channel.

Implementation	Technology	65 nm CMOS
	Die Area	1.3 mm×1.4 mm
	Digital Supply Voltage	1.0 V
	Analog Supply Voltage	1.0 V
	Reference Clock Frequency	10 MHz
Core UWB Channel Information	Center Frequency	1-18 GHz
	10 dB Bandwidth	12.7 GHz
System Performance	Fine-Range Bin Resolution	0.94 mm
	Radar Range	15 m
	Max Integration Time	1.5 μs
	SNR Improvement (Theory)	48 dB
	RMS Jitter (Simulation)	< 8 ps
Power	Total Power Consumption	76 mW

Summary of UWB radar transceiver

RADAR SCANNING MECHANISM AND HUMAN REESPIRATION MODELS

This section describes the radar scanning mechanism of the front end chip and introduces the human respiration models and their features. The proposed radar signal processing platform adopts a UWB radar chip to capture remote human respiration signals through a wireless channel. This UWB radar chip was implemented using 65nm complementary metal-oxide semiconductor (CMOS) technology. Table 1 summarizes the measurement results of UWB CMOS transceiver chip. The UWB radar chip has a tunable center frequency from 1 to 18 GHz and a tunable 10 dB bandwidth from 7.3 to 12.7 GHz. The gigaherz-level centre frequency and radio bandwidth provide the benefits of high ranging resolution and small antenna size.The radar chip contains a UWB waveform generator in the transmitter (TX), and a single pole double throw switch, a low-noise amplifier, and an analog signal processing array in the receiver(RX).This UWB impulse radar repeatedly transmits short pulses at a repetition frequency of 10 MHZ through the transmitting antenna and samples the received signals at the same frequency in the receiver.

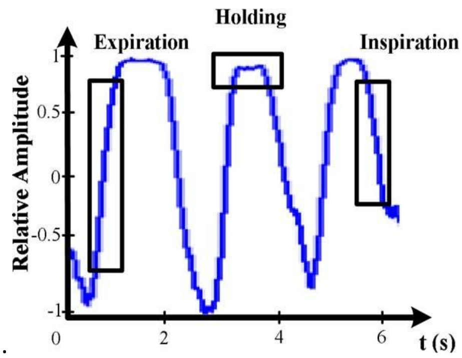


Fig.2.Radar-captured human respiratory signal

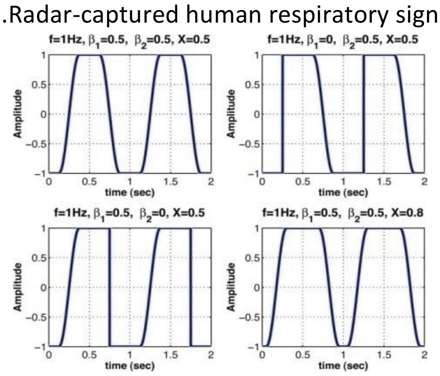


Fig.3. MRCW Waveforms of various f THE

PROPOSED RESPIRATION MODEL: four segment linear waveform

A physiological study reported that a pricewise linear region curve yields on optiml fit for certain biological signals including the respiration signal. Our observation also shows that radar-captured respiration signals tend to exhibit more piece-wise linear characteristic than sinusoidal characteristics. However they presented a linear regression algorithm for only a specific number of linear segments and segment transition. This type of exhaustive search incurs a considerably high computational cost.

In clinical diagnosis the inspiration and expiration are more informative than the respiration rate when evaluating the lung condition of a patient. Therefore, the previously proposed MRCW waveform was employed to model these essential features based on the curvature of the sinusoidal waveform. These parameters can be extracted using the proposed correlation search algorithm; however the reconstructed waveform shows that the MRCW modal cannot effectively fit the respiration signal, particularly at the respiration signal. Four linear segments can be intuitively determined to model four respiratory features: expiration speed, inspiration speed, holding time after expiration, and holding time after inspiration. This observation saved served as the motivational to devise a piecewise linear model. The MRCW model shows the two holding segment in the MRCW waveform. Consequently the other two linear segments are used to fit the raisng slope of the respiration signal.

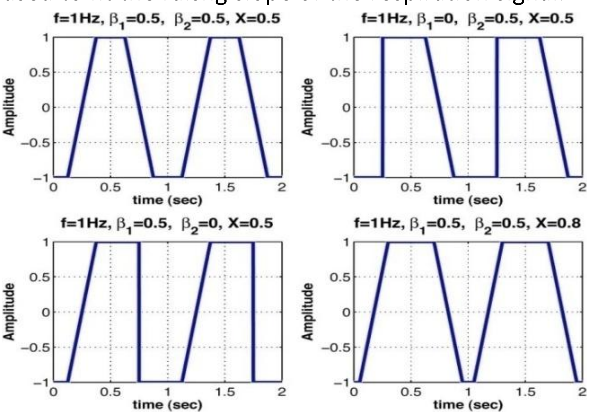


Fig.4.Fslw waveform variation

Ultra wide band radar signal processing is done here by using the ARM cortex M4 which has a high efficiency and capability of signal processing. ARM is the one of the famliy of the CPUs based on RISC. spread spectrum analysis generates the signal with larger bandwidth. RSSI is the received signal strength indicator. Filter and amplifier which is used to amplify and FSLW respiration model and compare the performance and complexity.

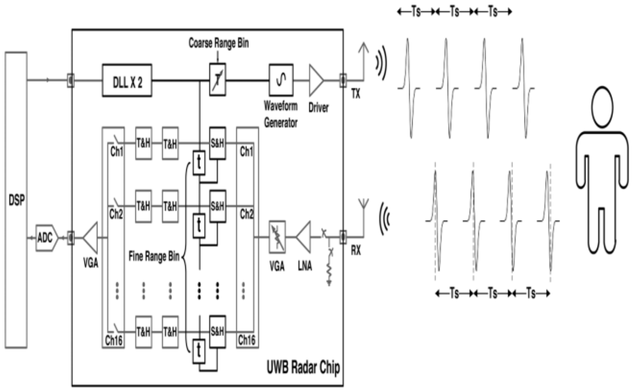
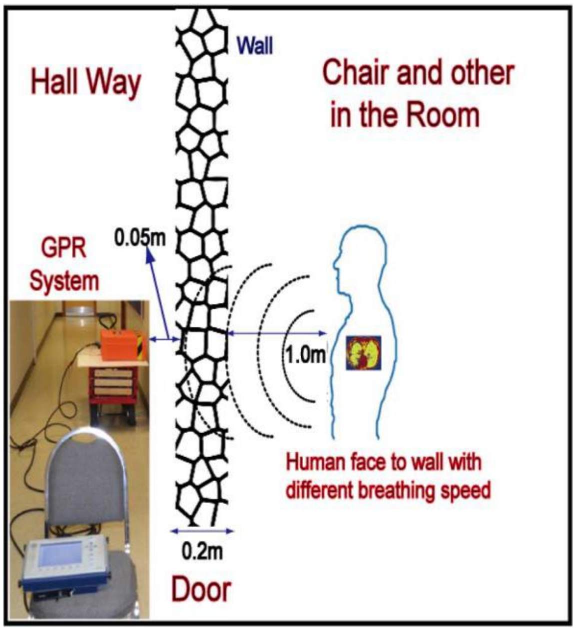


Fig.6. UWB radar CMOS architecture.

Experimental set up:



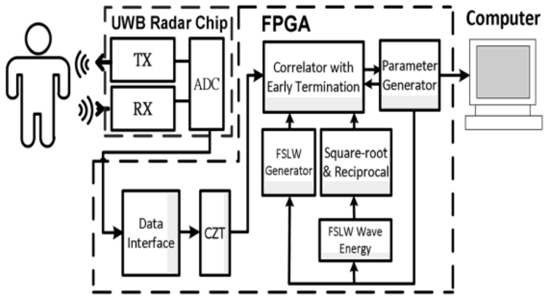


Fig.6.Architecture of the radar signal processing platform for respiratory feature extraction

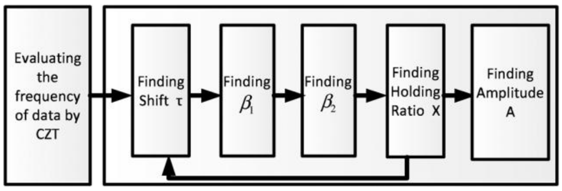


Fig.7. Flowchart for iterative algorithm

REFERENCE

[1]. L.B. Liu,Z.Liu, and B.Barrowes "Through-wall bio-radioactive with UWB impulse radar: observation, simulation and signal extraction, " IEEE J.sel Topics Appl Earth Observ, vol4, no. 4,pp.791-798, Dec. 2011

[2]. Immoreev and T. Tao."UWB radar for patient monitoring,"IEEEAerosp Electron Syst Mag., vol 23, no.11,pp. 11-18, Nov.2008

[3]. Li,Z.F.Zeng,J,G. Sun, and F.S.Liu "Through wall detection of human being's movement by UWB radar,"IEEEGeosci Remote ENS Lett, vol.9, no.6,pp. 1079-1083, Jun. 2012.

[4]. A.Lazaro et al, "Vital signs monitoring using Impulse based UWB radar signals," in Proc.41st Eur. Microwave conf., Oct.2011,pp.135-138.