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HARDWARE IMPLEMENTATION OF UWB RADAR FOR DETECTION OF TRAPPED VICTIMS IN COMPLEX ENVIRONMENT

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Abstract- Ultra-wideband (UWB) radar plays an important role in search and rescue at disaster relief sites. Identifying vital signs and locating buried survivors are two important research contents in this field. In general, it is hard to identify a human's vital signs (breathing, body temperature, brain waves and heartbeat) in complex environments due to the low signal-to-noise ratio of the vital sign in radar signals. In this paper, advanced signal-processing approaches are used to identify and to extract human vital signs in complex environments. First, we apply Curvelet transform to remove the source–receiver direct coupling wave and background clutters. Next, singular value decomposition is used to de-noise in the life signals. Finally, the results are presented based on FFT and Hilbert-Huang transform to separate and to extract human vital sign frequencies, as well as the micro-Doppler shift characteristics. The proposed processing approach is first tested by a set of synthetic data generated by FDTD simulation for UWB radar detection of two trapped victims under debris at an earthquake site of collapsed buildings.

Index terms: Ultra-wideband (UWB)Receiver Signal Strength Indicator(RSSI),Control and Status Register

I. INTRODUCTION

Collapse of man-made structures, such as buildings and bridges earth quakes and fire accident, occur with varying frequency across the world. In such a case, survived human beings are often trapped in the cavities created by collapsed building material. Common cause of such collapses is overloaded due to faulty construction, faulty design, fire, gas explosions, terrorists acts, but the single most common and devastating cause of collapse of man-made structures is earthquake. Large-scale earthquakes with magnitudes larger than 7.0 on the Richter scale often result in more or less severe damage to buildings. The United States Geological Survey (USGS) estimates that, since 1900, there have occurred an average of 18 major earthquakes (magnitude 7.0-7.9) and one great earthquake (magnitude 8.0 or greater) per year, and that this average has remained relatively stable. Although some of the causes of collapse of man-made structures can be reduced in the foreseeable future, they cannot be fully eliminated, particularly not the magnitude and the frequency of earthquakes. Thus, the case of trapped victims buried under rubble is a continuous threat that the mankind has to cope with.Ultra Wide Band (UWB) Radar is a radio technology which has to be used in a very low energy level due to short range. The principles are time domain and frequency domain. In time domain it is extremely short pulses and low duty cycle. In frequency domain it is an Ultra wide spectrum and low power spectral density. A new radar development is the transition to signals with a wide and Ultra-Wide band's. The UWB radar increases due to the smaller pulse volume of the signal. The UWB radar can reduce the signal length to improve detected target range measurement accuracy.

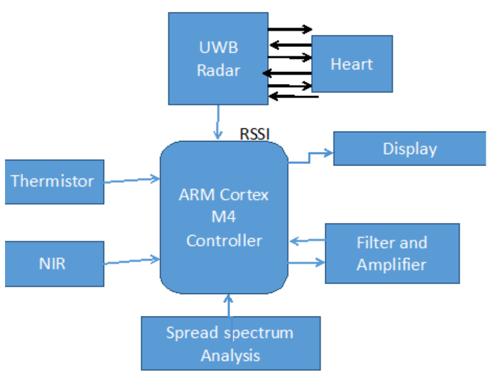
II. LITERATURE SURVEY

The author [1] mention the problem of reconstructing total-time responses from noisy data collected by ground-penetrating radar (GPR). The well-known singularity expansion method (SEM) - a theory - for late-time response representation is generalized to establish a matrix model (data matrix) representing total-time responses of radar scattering waveforms. Using singular value decomposition of the data matrix - an intermediate processing technique, it present an approach to model-order determination and successfully reconstruct the total-time responses. The model order is quantitatively selected by spectral analysis of left singular vectors of the data matrix and of the emitted waveform. The most important discoveries in this letter are as follows: (1) the GPR upper frequency can be used as a criterion for the selection of left singular vectors of the data matrix, and (2) the left singular vectors of the data matrix, which should not be neglected, tend to be predominantly low-pass functions and also provide valuable information for model-order determination [2].The micro Doppler signals of human's heartbeat, breathe and arm moving using through wall radar are non-linear and non-stationary which can be analyzed. In homeland security and law enforcement situations, it is often required to remotely detect human targets obscured by walls and barriers. In particular, it can specifically interested in scenarios that involve a human whose torso is stationary. In proposed system a technique to detect and characterize activity associated with a stationary human in through-the –wall scenarios using a Doppler radar system. The presence of stationary humans is identified by detecting Doppler signatures resulting from breathing, and movement of the human arm and wrist[3]. The irregular, transient, non-uniform, and non-stationary nature of human activity presents a number of challenges in extracting and classifying Doppler signatures from the signal. These are addressed using bio-mechanical human arm movement models and the empirical mode decomposition (EMD) algorithm for Doppler feature extraction. Experimental results demonstrate the effectiveness of our approach to extract Doppler signatures corresponding to human activity through walls using a 750-MHz Doppler radar system[4].A Curvelet transform (CT) is a new kind of multi-scale analysis algorithm which is more suitable for image processing; as compared with a wavelet transform (WT), it can better analyses the line and curve edge characteristics, and it has better approximation precision and sparesity description and also has good directivity. This paper introduces ground roll suppression of a seismic signal based on a fast discrete curvelet transform (FDCT) and the direct wave removal in ground penetrating radar (GPR) based on a CT. A ground roll is an interferential wave existing widely in seismic data, and it is an important step in seismic data processing to suppress ground roll [5].The method can separate the different waves at the same time because of CT characteristics of frequency and direction. In the ground penetrating radar signal, the direct wave is a strong noise which has line singularity. In the time-space domain, the useful information in the GPR signal is badly polluted by a strong direct wave so that the underground objects cannot be recognized correctly. The FDCT is employed to remove the background noise and separate the direct wave. The experimental results show that a CT has better effects in ground-roll suppression and direct wave removal[6].The cardio-respiratory signatures of human beings were studied using both an ultra-wide band (UWB) impulse radar system in a laboratory through-wall experiment and a numerical simulation using the finite difference time domain (FDTD) method. Signals from both the physical experiment and numerical simulation are processed with the Hilbert-Huang Transform (HHT), a novel signal processing approach for nonlinear and non-stationary data analysis. The results show that by using the HHT, human respiration characteristics can be successfully identified and differentiated for different subjects and a variety of respiratory statuses. However, reliable detection of cardiologic signatures requires a radar system with higher central frequency. Our results demonstrate that this combination of UWB impulse radar and HHT data processing has potential for through-wall life detection and possibly other applications[7]. The ultra-wide band (UWB) radar has greater advantage in estimate positions and shapes of the target in Through Wall Imaging (TWI). One significant characteristic of human beings is the periodic motion, such as respiration and movement of arms. In this paper, we apply the UWB pulse radar to detect the periodic motion in through-wall detection. We present methods based on the FFT and time-frequency analysis to detect periodic motions characters using the TWI data. In particular, we extract the frequency of the periodic motion, characterize time-frequency features, the size and position of the human being from the TWI images. It is straight forward to use the method in other applications such as earthquake and fire rescue.Ultra wideband (UWB) radar technology has emerged as one of the preferred choices for through-wall detection due to its high range resolution and good penetration[8,9. The resolution is a result of high bandwidth of UWB radar and helpful for better separation of multiple targets in complex environment. Detection of human targets through a wall is interesting in many applications. One significant characteristic of human is the periodic motion, such as breathing and limb movement. In this letter, applying the UWB radar system in through-wall human detection and present the methods based on fast Fourier transform and S transform to detect and identify the human's life characteristic. In particular, it can extract the centre frequencies of life signals and locate the position of human targets from experimental data with high accuracy. Compared with other research studies in through-wall detection, this letter is concentrated in the processing and identifying of the life signal under strong clutter. It has a high signal-to-noise ratio and simpler to implement in complex environment detection. It can use the method to search and locate the survivor trapped under the building debris during earthquake, explosure or fire[10].

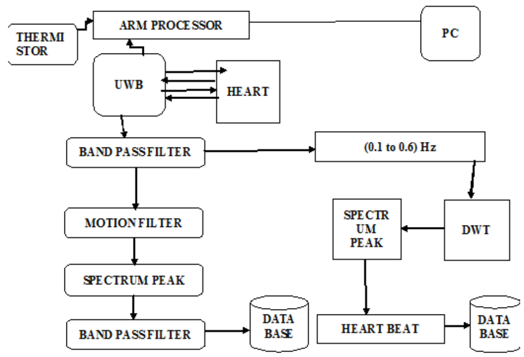
III. PROPOSED METHOD

The proposed system not only detects whether the person is dead or alive and also give the decision support of the diagnosis for treatments. Since lot of death occurs due to the failure in the fast diagnosis and treatments. Distance between the hospital and the collapse environment and decision making by the doctors leads to many deaths, where as a hand held device, data in any of the variables of cardiac and breathing helps extract stays that are under similar clinical conditions and gives the support for the medical team to give the first aid.

The figure 1 shows the overall block diagram of the work. It consists of Ultra Wide Band (UWB) radar transceivers i.e., both transmit and receive the ultra-wide band signal to the collapsed environment. The victims are identified by their heart beat and respiration signal which is reflected from the victims. The received RSSI (Receiver Signal Strength Indicator) signal will be indicated by RSSI and it is band limited using band pass filter(BPF).The band limited signal contains essential signals from heart beat andrespiration conditions of the victims. The respiration signal is filtered using motion filter where the movement of victims and their respiration rate is monitored and filtered with processor then signal transformation is done using Discrete Wavelet Transform (DWT) of Haar wavelet functions are applied to get peak values of heart and respiration signal from the obtained result. The database for the victims are stored for further initial medical treatment before hospitalization



(a)

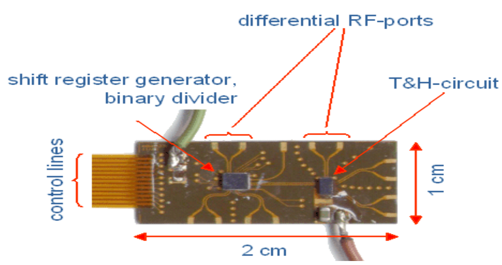


(b)

Fig 1(a) Block diagram of UWB RadarFig1(b) Block diagram of UWB Radar

3.1 M- sequence UWB radar module with 5 GHz bandwidth

Ultra wideband (UWB) is an emerging field which has huge potential in Sensor Technology. UWB sensors take advantage of the properties of the electromagnetic field over a very large bandwidth. The below diagram fig 2 is M-sequence UWB Radar module. They are used for high-resolution remote sensing of their environment and non-destructive volume investigation. Depending on the application and the specific design of the sensors, this information includes geometric values or/and material and related properties. Typical UWB applications cover high resolution radar, precise positioning, object identification and impedance spectroscopy.



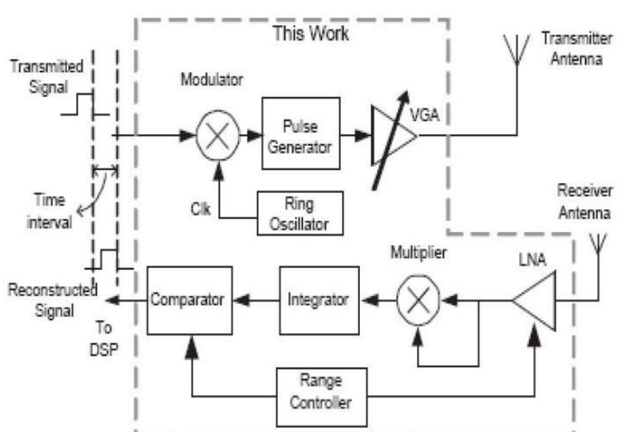


Fig 2 M- sequence UWB radar module with 5 GHz bandwidth

Fig 3 Architecture of the UWB radar transceiver

Specific applications are high resolution short range radar for surveillance, distance and speed measurement in vehicular technology, object recognition and tracking, indoor navigation and positioning, microwave imaging, surface and wall penetrating radar for material layer analysis and detection of hidden objects, persons or landmines (humanitarian demining), detection of biologic activity (heartbeat, respiration), impedance spectroscopy to characterize inorganic and organic substances, etc. Hence an integrated UWB-Radar-System was developed.

When designing a UWB radar transceiver system as shown in fig 3, two design aspects need to be considered, architecture and implementation. Different architecture set the fundamental performance capabilities of the design, and good implementation choices improves radar performances. Impulse radar detection range depends on radiated energy, transmitter and receiver design, target size, and signal processing. Among various UWB transceiver architectures, the impulse-based energy detection UWB transceiver architecture is discussed here.An example of the impulse-based energy detection transceiver architecture is shown in Figure 3. In this architecture, the transmitter sends a pulse train toward the target. The interface between two Medias produces a partial reflection. Then the receiver detects and samples this particular type of reflected pulse train, and the decision circuit makes the final decision. Pulses are diffracted and scattered by different tissue layers and organs in human body. Channel distortion and power loss easily destructs the reflected pulses and make them undistinguishable. The rang-gate is designed to look for the destined reflected pulse rather than wait and receive every reflected pulse from every location and try to identify the expected return pulse, which in many cases are very week and tangled with other return pulses. The receiver samples only the pulses arriving at the receiver during a very narrow time window after pulse transmission, as shown in Figure. By estimating the distance of the expected target, a delay time is chosen.This proposed transceiver architecture enormously reduces the circuitry complexity and power consumption. The transmitter consists of a modulator, a pulse generator, and a variable gain amplifier (VGA) driver. An on-off keying (OOK) modulation scheme is used to modulate the pulse. The VGA and driver are used to amplify output and match output impedance. The receiver consists of a low noise amplifier (LNA), a correlator, an integrator, a clocked voltage comparator, and a delay controller. The input clock train and control signal are modulated to a sequence of clock pulse, which then enters the pulse generator to produce a pulse train. This pulse train is passed onto a driver amplifier and then to an UWB antenna. The reflected pulse is caught by the antenna in the non-coherent receiver and amplified by a LNA. The signal then is squared by a multiplier at the asynchronous receiver. The squared output is then fed into an integrator and clocked comparator to boost up the voltage and reconstruct the signals. The range controller uses logic gates to switch on/off the LNA and disable the sampling operation.

3.3 A range gate at receiver opens briefly after a fixed delay time to sample the reflected pulse.

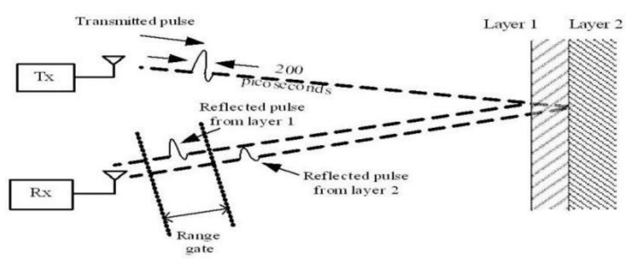


Fig4 A range gate at receiver

The fig 4 has two classes of UWB signals are utilized to transmit symbols in UWB system: carrier-free impulse signal, and carrier-based short sinusoidal signal. The impulse UWB signal is often represented using Gaussian (different orders of Gaussian derivatives), Rayleigh, or Hermitian pulse. The advantages of impulse signal are that the impulse-based transceiver architecture often very simple and consume the least amount of power due to its low pulse repetition rate and low duty cycle. However, the drawback for impulse-based signal is the frequency characteristic is largely determined by the pulse shape. Compared to the impulse-based signal, the carrier-based UWB uses sinusoidal wave instead of short pulse to represent signals, and these signals are easier to manage within the FCC spectrum and produce less distortion.

3.4 ARM Processor

ARM (Advanced Risc Machine) is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture developed by

British company ARM Holdings.A RISC-based computer design approach means ARM processors require significantly fewer transistors than typical CISCx86 processors in most personal computers. This approach reduces costs, heat and power use. These are desirable traits for light, portable, battery-powered devices—including smart phones, laptops, tablet and notepad computers, and other embedded systems.

A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing improved energy efficiency for servers. ARM Holdings develops the instruction set and architecture for ARM-based products, but does not manufacture products. The company periodically releases updates to its cores. Current cores from ARM Holdings support a 32-bitaddress space and 32-bit arithmetic; the ARMv8-An architecture, announced in October 2011, adds support for a 64-bit address space and 64-bit arithmetic. Instructions for ARM Holdings' cores have 32 bits wide fixed-length instructions, but later versions of the architecture also support a variable-length instruction set that provides both 32 and 16 bits wide instructions for improved code density. Some cores can also provide hardware execution of java byte codes.ARM Holdings licenses the chip designs and the ARM instruction set architectures to third parties, who design their own products that implement one of those architectureincluding systems-on-chips (SoC) that incorporatememory, interfaces, radios, etc. Currently, the widely used Cortex cores, older "classic" cores, and specialized Secure Core cores variants are available for each of these to include or exclude optional capabilities. Companies that make chips that implement an ARM architecture include Apple, AppliedMicro, Atmel, and Broadcom, Freescale Semiconductor, NVidia, NXP, Qualcomm, Samsung Electronics, ST Microelectronics and Texas Instruments. Qualcomm introduces new three-layer 3D chip stacking in their 2014-15 ARM SoCs such as in their first 20 nm 64-bit octal-core. Globally ARM is the most widely used instruction set architecture in terms of quantity produced. The low power consumption of ARM processors has made them very popular: over 50 billion ARM processors have been produced as of 2014, thereof 10 billion in 2013 and "ARM-based chips are found in nearly 60 percent of the world’s mobile devices".

In 2008, 10 billion chips had been produced.The ARM architecture (32-bit) is the most widely used architecture in mobile devices, and most popular 32-bit one in embedded systems. In 2005, about 98% of all mobile phones sold used at least one ARM processor. According to ARM

Holdings, in 2010 alone, producers of chips based on ARM architectures reported shipments of 6.1 billion ARM-based processors, representing 95% of smart phones, 35% of digital television and set-top boxes and 10% of mobile computers.

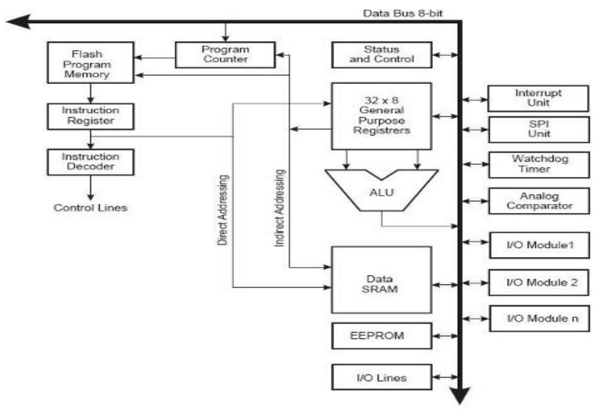


Fig5 Block Diagram System Architecture

The figure 5 shows that system architecture block diagram. In that, it consists of flash program memory, program counter, status and control, instruction register, instruction decoder, general purpose registers, ALU, data SRAM, EEPROM, I/O lines

3.5 Flash Program Memory

Flash memory is a type of constantly-powered non-volatile memory that can be erased and reprogrammed in units of memory called blocks.

3.6 Program Counter

The program counter (PC), commonly called the instruction pointer (IP) in Intel x86 and Itanium microprocessors, and sometimes called the instruction addressregister (IAR). In most processors, the PC is incremented after fetching an instruction, and holds the memory address of (“points to”) the next instruction that would be executed.

3.7 Status and Control

Control and Status Register (CSR) is a register in many central processing units that are used as storage devices for information about instructions received from machines. The device is generally placed in the register address 0 or 1 in CPUs and works on the concept of using a comparison of flags (carry, overflow and zero.

3.8 Instruction Register

An instruction register (IR) is the part of a CPU's control unit that stores the address of the next instruction currently being executed or decoded. In simple processors each instruction to be executed is loaded into the instruction register which holds it while it is decoded, prepared and ultimately executed. In the Instruction cycle, the instruction is loaded into the Instruction register after the processor fetches it from the memory location pointed by the Program counter.

3.9 Instruction Decoder

The instruction decoder is the part of the CPU that converts the bits stored in the instruction register – or, in CPUs that have microcode, the microinstruction – into the control signals that control the other parts of the CPU.

3.10 General Purpose Registers

General purpose registers (GPRs) can store both data and addresses, i.e., they are combined Data/Address registers and rarely the register file is unified to include floating point as well.

3.11 ALU

An arithmetic logic unit (ALU) is a digital circuit that performs integer arithmetic and logical operations. The ALU is a fundamental building block of the central processing unit of a computer, and even the simplest microprocessors contain one for purposes such as maintaining timers. The processors found inside modern CPUs and graphics processing units (GPUs) accommodate very powerful and very complex ALUs; a single component may contain a number of ALUs.

3.12 Data SRAM

Static random-access memory (SRAM or static RAM) is a type of semiconductor memory that uses bi stable latching circuitry to store each bit. SRAM is more expensive and less dense than DRAM and is therefore not used high capacity.

3.13 EEPROM

EEPROM stands for Electrically Erasable Programmable Read-Only Memory and is a type of non-volatile memory used in computers and other electronic devices to store small amounts of data that must be saved when power is removed. An EPROM usually must be removed from the device for erasing and programming, whereas EEPROMs can be programmed and erased in-circuit, by applying special programming signals.

3.14 I/O Lines

I/O lines is an input and output lines. It is used for exchange purpose. It can communicate with any peripherals. The external environment communicate or interact with the processor internal bus(address bus or data bus)

3.15 Interrupt Unit

An interrupt is a signal to the processor emitted by hardware or software indicating an event that needs immediate attention. An interrupt alerts the processor to a high-priority condition requiring the interruption of the current code the processor is executing (the current thread). The processor responds by suspending its current activities, saving its state, and executing a function called interrupt handler(or interrupt service routine, ISR) to deal with the event. This interruption is temporary, and after the interrupt handler finishes, the processor resumes execution of the previous thread.

3.16 SPI Unit

A serial peripheral interface (SPI) is an interface that enables the serial (one bit at a time) exchange of data between two devices, one called a master and the other called a slave An SPI operates in full duplex mode. This means that data can be transferred in both directions at the same time. The SPI is most often employed in systems for communication between the central processing unit (CPU) and peripheral devices.

3.17 Band Pass Filter

Band pass is an adjective that describes a type of filter or filtering process; it is to be distinguished from pass band which refers to the actual portion of affected spectrum. Hence, one might say "A dual band pass filter has two pass bands." A band pass signal is a signal containing a band of frequencies not adjacent to zero frequency, such as a signal that comes out of a filter. The circuit diagram of band pass filter is show below fig 6

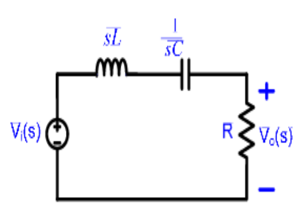


Fig 6 circuit of band pass filter

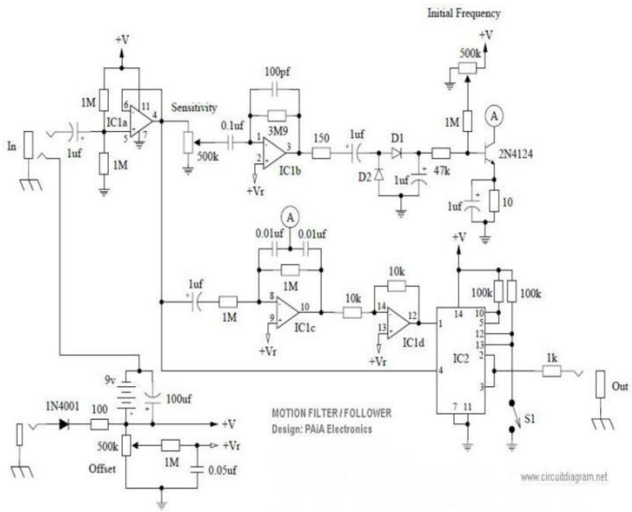


Fig 7 Circuit diagram for Motion filter

Motion filteris nothing but movement of objects whether the person who are trapped in the building collapsed environments. In the figure 7, the input signal is taken as mike, here the AC signal only taken; the DC signal is blocked. From the AC signal coupling capacitor is used for dividing the voltage and then amplifying the circuit sensitivity is required. From the sensitivity signal again coupling capacitor is used and then amplifying initial frequency is required. The sensitivity signal again the coupling capacitor is used and then amplifying, it is given to the IC; from that output signal is required. Motion filter is the result of the relative motion between the camera and the original scene during the integration time of the image. The motion filter effect is often used in computer graphics to make synthetic images and animations look more realistic and to add additional information about the art and the direction of the motion. On the other hand, the real world images often suffer from very strong motion filters. The process of motion de-filtering can be divided into two parts: the estimation of the function that caused the filter, and applying a restoration algorithm.

3.18 Spectrum peak level for probability distribution

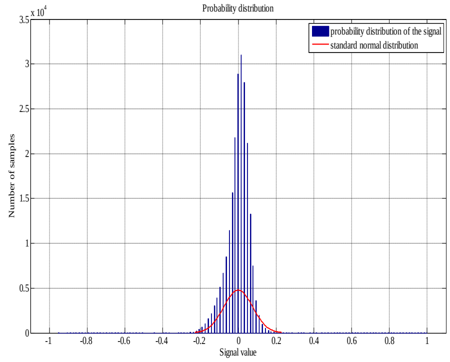


Fig 8 Spectrum Peak level

Spectrum peak as shown in the fig 8 is to view the signal in probability theory, a probability density function (pdf), or density of a continuous random variable, is a function that describes the relative likelihood for this random variable to take on a given value. The probability of the random variable falling within a particular range of values is given by the integral of this variable's density over that range—that is, it is given by the area under the density function but above the horizontal axis and between the lowest and greatest values of the range.The probability density function is nonnegative everywhere, and its integral over the entire space is equal to one. The terms "probability distribution function" and "probability function" have also sometimes been used to denote the probability density function. However, this use is not standard among probabilities and statisticians. In other sources, "probability distribution function" may be used when the probability distribution is defined as a function over general sets of values, or it may refer to the cumulative distribution function, or it may be a probability mass function rather than the density.

3.19 Discrete Wavelet Transform

In numerical analysis and functional analysis, a discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled. As with other wavelet transforms, a key advantage it has over Fourier transforms is temporal resolution: it captures both frequency *and* location information (location in time).Wavelet transform decomposes a signal into a set of basic functions (wavelets). Wavelets are obtained from a single prototype wavelet Ψ (t) called mother wavelet by dilations and shifting:

$$\psi_{a,b}(t) = \frac{1}{\sqrt{a}}\psi(\frac{t-b}{a}) \qquad \text{-------------------------------------}(1)$$

Where

a is the scaling parameter b is the shifting parameter.

3.20 Wavelet decomposition of two-dimensional pictures.

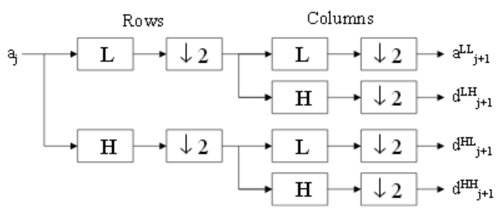


Fig9 block diagram of wavelet decomposition

The figure 9 shows the wavelet decomposition for 2-dimensional pictures. It will occurs the images of rows and then columns. Here the input is given to L and H which is present in rows. L is nothing but Low and H is nothing but high. These rows are given to the columns which has the pair of low and high and we can get the output. In discrete wavelet transform, it represents a signal in terms of discrete waves. Discrete transform provides a signal in both time and frequency domain. If a signal has a discontinuity, wavelet transform (WT) produces few number of coefficients. Hence discrete wavelet transform gives better solution compare with Fourier transform (FT).Because FT provides a signal only in frequency domain. If a signal has a discontinuity means FT provides large number of coefficients.

The Ortho normal expansion of x[n] is of the form

$$x[n] = \sum_{k\varepsilon Z} \langle \phi_k[l], x[l] \rangle \phi_k[n] = \sum_{k\varepsilon Z} X[k]\phi \qquad (2)$$

$$\text{where X}[\text{k}] = \langle \phi_k[l], x[l] \rangle = \sum_{l} \phi_k^*[n] \qquad (3)$$

Normally Discrete Wavelet Transform is of two types: 1.Haar Wavelet Transform and 2. Daubechies Wavelet Transform. DWT belongs to linear transformation method that has to be used in a data vector. It is nothing but a tool which separates a data into different frequency components.

IV. EXPERIMENTAL RESULTS

In order to evaluate whether the above signal-processing approach is suitable for not only synthetic data, but also for experimental data, we carry out the through-wall radar detection experiment for human's breathing frequency under different conditions. The experimental system is the GSSI SIR-3000 Radar, Which is good choice for data accuracy and versatility. The antenna is the horn antenna with a center frequency of 2GHZ. In the experiment, the humans keeps a distance of about 1.0 m from the above with different breathing conditions, such as eupnea, bradynea,and tachynea, respectively. The antenna is fixed position above at a distance of 1m. The data is acquired for 40 s of recording time with a scan rate of 120 scan/sec. The below figure 9 shows the human fast breathing detection data after de-noising with CT method.

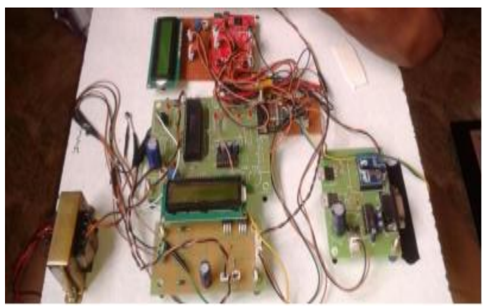


Fig 9 Experimental setup.

From this result we can easily find the human response signal. (Human heart beat and Breathing frequency).

4.1 Heart Beat and Respiration Rate

The cardiac cycle refers to a complete heartbeat from its generation to the beginning of the next beat, and so includes the diastole the systole and the intervening pause. The frequency of the cardiac cycle is described by the heart rate, which is typically expressed as beats per minute. Each beat of the heart involves five major stages. The first two stages, often considered together as the "ventricular filling" stage, involve the movement of blood from the atria into the ventricles.

The next three stages involve the movement of blood from the ventricles to the pulmonary artery (in the case of the right ventricle) and the aorta (in the case of the left ventricle).The first stage, "early diastole," is when the semilunar valves (the pulmonary valve and the aortic valve) close, the atrio-ventricular (AV) valves (the mitral valve and the tricuspid valve) open, and the whole heart is relaxed. The second stage, "atrial systole," is when the atrium contracts, and blood flows from atrium to the ventricle.

The third stage, "isovolumic contraction" is when the ventricles begin to contract, the AV and semilunar valves close, and there is no change in volume. The fourth stage, "ventricular ejection," is when the ventricles are contracting and emptying, and the semilunar valves are open.

During the fifth stage, "isovolumic relaxation time", pressure decreases, no blood enters the ventricles, the ventricles stop contracting and begin to relax, and the semilunar valves close due to the pressure of blood in the aorta

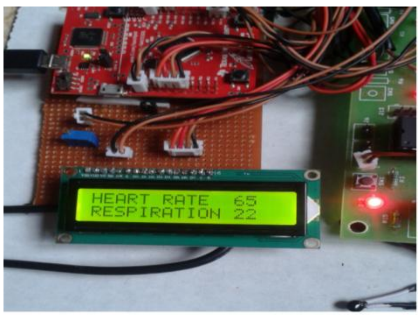
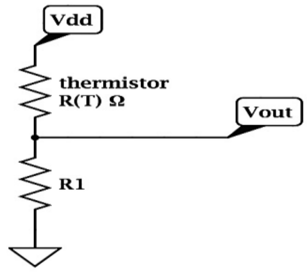


Fig 10 Heart Beat and Respiration Rate setup

The respiratory rate (RR), also known as the respiration rate, ventilation rate, ventilatory rate, ventilation frequency (Vf), respiration frequency (Rf), pulmonary ventilation rate, or breathing frequency, is the rate (frequency) of ventilation, that is, the number of breaths(inhalation-exhalation cycles) taken within a set amount of time (typically 60 seconds). A normal respiratory rate is termed eupnea, an increased respiratory rate is termed tachypnea and a lower than normal respiratory rate is termed bradypnea. Breathing (which in organisms with lungs is called ventilation and includes inhalation and exhalation) is a part of respiration. Thus, in precise usage, the words breathing are hyponyms, not synonyms, of respiration; but this prescription is not consistently followed, even by most health care providers, because the term respiratory rate (RR) is a well-established term in health care, even though it would need to be consistently replaced with ventilation rate if the precise usage were to be followed. The output of the heart beat and respiration rate setup was shown in the fig 10.

4.2 Body Temperature

Thermistor is a device for detecting temperatures which differ from a variable norm of particular use in detecting elevated temperatures in cattle. The device, one being attached to each animal, includes a square wave generator, an identification number encoder for outputting the identification number of the particular animal in the herd, a fever detector with an ambient temperature compensating circuit which provides output only when internal temperature of the animal is above a preset value for a given ambient temperature, and a transmitter which sends the identification code to a receiver. In certain embodiments, no separate fever detector is provided; rather the square wave generator outputs a frequency-modulated signal related to the internal body temperature.



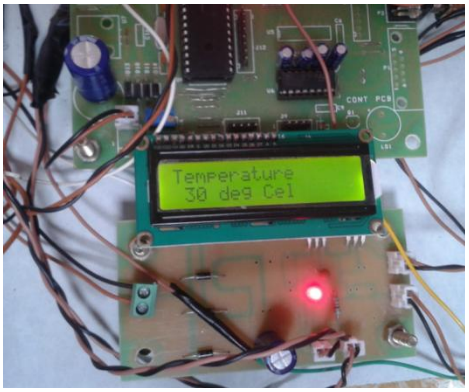


Fig 11 circuit diagram of temperature sensorFig 12 Body Temperature setup

Of particular interest is the identification number encoder which intermittently outputs a preset hardwired identification code to the transmitter at periodic intervals for transmission to a receiver either at constant intervals or when temperatures sensed by a temperature detector exceed the variable norm by a preset given amount. The output is shown in fig 11&12.

4.3 Brain Waves

At the root of all our thoughts, emotions and behaviors is the communication between neurons within our brains. Brainwaves are produced by synchronized electrical pulses from masses of neurons communicating with each other. Brainwaves are detected using sensors placed on the scalp. They are divided into bandwidths to describe their functions in fig 13(a&b), but are best thought of as a continuous spectrum of consciousness; Delta being slow, loud and functional - to Gamma being fast, subtle, and complex.

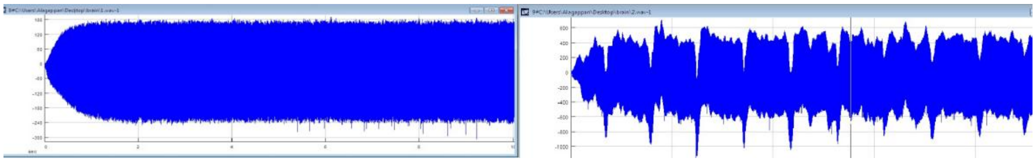


Fig 13 (a) deadFig 13 (b) alive

It is a handy analogy to think of Brainwaves as musical notes - the low frequency waves like a deeply penetrating drum beat, while the higher frequency brainwaves are like a subtle high pitched flute. Our brainwaves change according to what we're doing and feeling. When slower brainwaves are dominant we can feel tired, slow, sluggish, or dreamy. The higher frequencies are dominant when we feel wired, or hyper-alert.The descriptions that follow are only broadly descriptions - in practice things are far more complex, and brainwaves reflect different aspects when they occur in different locations in the brain. Brainwave speed is measured in Hertz (cycles per second) and they are dived into bands delineating slow, moderate, and fast waves.

4.4 NIR Sensor

The near IR sensor (PRM/NIR Sensor) is a low cost portable system designed for time-resolved tissue diagnosis, especially hematoma detection in the emergency care facility. The sensor consists of a personal computer and a hardware unit enclosed in a box of size 37 X 37 X 31 cm3 and of weight less than 10 kg. Two pseudo-random modulated diode lasers emitting at 670 nm and 810 nm are used in the sensor as light sources. The NIR sensor is show in fig 14.

Fig 14 NIR Sensor

The sensor can be operated either in a single wavelength mode or a true differential mode. Optical fiber bundles are used for convenient light delivery and color filters are used to reject room light. Based on a proprietary resolution- enhancement correlation technique, the system achieves a time resolution better than 40 ps with a PRM modulation speed of 200 MHz and a sampling rate of 1-10 Gs/s. Using the prototype sensor, phantom experiments have been conducted to study the feasibility of the sensor.Brain's optical properties are simulated with solutions of intralipid and ink. Hematomas are simulated with bags of paint and hemoglobin immersed in the solution of varies sizes, depths, and orientations. Effects of human skull and hair are studied experimentally. In animal experiment, the sensor was used to monitor the cerebral oxygenation change due to hypercapnia, hypoxia, and hyperventilation. Good correlations were found between NIR measurement parameters and physiological changes induced to the animals.

V. CONCLUSION

The present study concluded that is to determine the UWB radar of advanced signal processing and data mining to identify the victims in building collapsed environments. Using the Discrete Wavelet Transform (DWT) to provide a better solutions. Using the Haar Wavelet Transform to analyze the signals. The spectral analysis with the DWT methods can separate and extract the breathing, heartbeat frequency, body temperature, brain waves from human life signals. Therefore the time–frequency characteristic of human's micro-Doppler shift is reflected, and the human's space position is identified. It shows that this combination of UWB radar and various processing methods has potential for identifying and extract human body's life signal in complex environment.In the future, work will continue on signal processingand target imaging for getting better detection (higher resolution) in through wall radar detection. One major objective is to identify and to classify the human's micro-Doppler shift characteristics with different motions such as human with weapons in complex environments. Moreover, developing the UWB radar experimental system which is suitable for weak signal detectionis also a valuable research field.

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