An Adequate Method For Detection Through The Wall And Localization Of Moving Targets Using UWB-IR

Author 1

MECNIL JENIFER Y
Student of Software Engineering
Easwari Engineering College
mecnics@gmail.com

Author 2

PRIYADHARSHINI C
Assistant Professor of IT Department
Easwari Engineering College
jp.kanishk21@gmail.com

Abstract—

Ultra wide band (UWB) is a technology for transmission of data using techniques with the very wide frequency band and low spatial density. The conventional radio system with the high data throughput used for communication devices, location, and the imaging device. The challenges of enabling a self-determined and safe life for a growing number of elderly people those who live alone in their home and in the case of emergency. Most of the elderly people face the problem of fall injuries, heart attack, cardio-respiratory problem when they are in a home. The rescues time, to find the location takes a mighty time. To overcome this issue monitor and rescue were done with the wearable sensor. In case if there is an absence of wearable sensor how to overcome. UWB radar helps to overcome this issue the UWB radar is fixed in the through-wall to estimate the target localization from the environment and the range estimates from the body, not being a point are analyzed, the relationship between radar placement and object position is analyzed. The Tracking system with UWB is done with target tracking algorithm. Removing the unwanted static object and elimination of furniture is done to detect the accurate target. The detection of the target and the range estimates the location of the target.

Index Terms— ***UWB target detection, range estimation,algorithm***

I. INTRODUCTION

Uwb is a technology with a high -speed, short range wireless communication, ranging and ad-hoc networking. IR technique is based on the transmission of very short pulse with low energy. UWB technology is suited for radio locationing with its large bandwidth and accuracy in ranging. Ultra-wide band (UWB) technology has been recognized as a feasible technology for wireless sensor networks (WSNs) applications due to its very good time-domain resolution allowing for precise location, tracking, coexistence with existing narrowband systems (due to the extremely low power spectral density) with low power and low cost on-chip implementation facility. Uwb transmission in any signal has a fractional bandwidth the signals can be calculated by nano seconds.

The impulse radio Uwb is a carrier- less transmission. This technology has a low transmit power and narrowness of transmitted pulses with a finite time resolution. Uwb –IR has fine time resolution which provides distance and location capability to wireless networks.

UWB has the potential to become the standard wireless unlicensed, short range, high speed network technology of the future. Federal Communications Commission (FCC) opened the door for commercial development. The high bandwidth (7.5 GHz in the US) makes the propagation through walls and other materials possible due to the presence of low frequencies in the sent signal.

Requirement for monitoring the state of the elderly in care facilities is increasing year by year and the increase in accidents involving them becomes great concern. An ultra-wideband impulse-radio (UWB-IR) monitoring sensor is suggested which focuses on the bed status most critical to the elderly that need the assistance immediately. The state detection algorithm based on ranging and motion estimation, the state can be detected that includes sleeping in a bed, sitting up in bed, falling down, wandering in room, going in and out at the door. The disadvantage is that the wearable sensor are used to monitor the person, an camera to detect the image, issues such as darkness may cause error. To overcome the UWB -IR technology, inbuilt in through wall radar fixed in the indoor environment to detect the target and the location.

Many applications require information about an object's location for rescue, emergency and security purposes. The approaches that access an object's location are typically divided into two groups: active and passive localization. In the existing, Ash J. N et al (2005) in his proposed work, the object is associated with a mobile station (MS), such as a tag or device in a communication network. The object's location is determined by sharing data between the MS and the base stations (BSs). The Global Positioning System (GPS), cellular networks, Bluetooth and wireless sensor networks

(WSNs) are used in active localization. In the latest method, Decarli et al (2014) says the object does not communicate with other devices. However, the object's location can be determined by using the reflected signal from the object.

Ultra-wide band (UWB) radar has become an emerging technology that is appropriate for indoor localization and tracking. UWB radar has many advantages, such as a high spatial resolution, the ability to mitigate interference, through-the-wall visibility, a simple transceiver and a low cost. In this, impulse-radio UWB (IR-UWB) radar is used to detect, localize and track a moving target in an indoor environment. IR-UWB radar has one transmitter and one receiver. The transmitter in the radar sends very narrow pulses, and the receiver receives the reflected pulses. The received signal passes through several signal-processing steps to extract the target signal. This target signal is generally by clutter, noise and attenuation. Therefore, removal of the unwanted signal and signal compensation are crucial tasks for improving the detectability of a target. The impulse used in an IR-UWB radar has an ultra-wide bandwidth and a very weak transmission power. Since the impulse is a noise-like signal, IR-UWB signal processing is normally performed in the time domain rather than the frequency domain.

How can we overcome the situation without monitoring any wearable sensor . The objectives of the proposal system are

- To detect the ranging and motion estimation.
- The Target Tracking Algorithm it is to detect the location of the target.
- FMCW (Frequency Modulated Continuous Waves) used to isolate reflections from different target and eliminate reflection off furniture and static object.
- The advanced Digital Signal Processing Modified is used to distinguish the motion of the target.

II. EXISTING SYSTEM

In the existing system, through wall Bio-Radiolocation can determine the cardio-respiratory signatures of human being using UWB. Lanbo Liu and Zijian Liu (2011) have proposed the detection of heart rate with UWB radar. The UWB impulse radar system is capable of detecting human beings by identifying the contrast between the human skin and the air. To meet the objective of detecting human vital signal in an indoor environment. The two commonly used UWB systems that is, the time domain impulse radar and the step frequency continuous wave (SFCW), the impulse radar is moderately fast for data acquisition but might have a problem with its linear dynamic range. A way around this bottleneck might be division of the total operational down-range in sub-ranges and operation within these sub-ranges. On the other hand, for the stepped-frequency continuous wave technique, while it possesses very good total power budget and dynamic range, but suffers from a relatively slow data acquisition, much longer time is needed than the impulse system measurement time, even with a fast frequency using UWB impulse radar in human life detection. The Hilbert-Huang transform (HHT) is a novel digital signal processing technique based on the combination of empirical mode decomposition (EMD) and the Hilbert spectral analysis (HSA). The HHT is designed specifically for extracting subtle signal features in extremely low signal noise ratio (SNR) environment and analyzing nonlinear, dispersive and non-stationary data. HHT should be an ideal approach to overcome the aforementioned difficulties in through-wall bio-radiolocation.

III. PROPOSED SYSTEM

In proposed system, the target tracking algorithm to detect a standard tracking, a within multiple target tracking algorithm implemented for moving objects with impulse-radio UWB (IR-UWB) radar in a short-range indoor area. This is achieved through signal-processing steps, such as clutter reduction, target detection, target localization and tracking. A signal-processing procedures is used in the clutter-reduction step, a from indoor environment and eliminating the false alarm Fast Fourier Transform FFT used to detect the motion of the target. An algorithm is developed to eliminate the unwanted target such as reflection from furniture and static object.

IV. METHODOLOGY

The Uwb tracking can be done by the following methods

- TARGET TRACKING ALGORITHM
- DETECTION
- ALGORITHM
- RANGE ESTIMATION FOR LOCATION

TARGET TRACKING ALGORITHM

Track initiation is the process of creating a new radar track from an unassociated radar plot. Tracking is essential for radar signal detects the presence of target using threshold detection method. It is based on time delay after pulse transmission and its radial velocity using Doppler measurement. . The angle measurement is done with monopulse tracking this shows the target location with time. When the tracker monitor, all the initial radar plots are used to create new tracks, but once the tracker is running, only those plots that couldn't be used to update an existing track are used for new tracks.

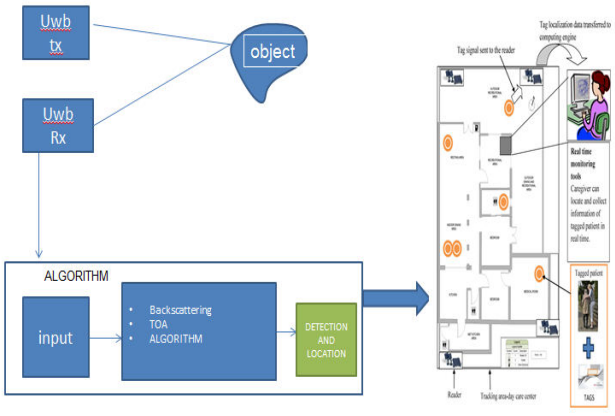

Fig 1.1 Architecture Of Proposed Method

A new track is given the status of tentative until plots from subsequent radar updates. Tentative tracks are not shown to the operator and so they provide a means of preventing false tracks from appearing on the screen - at the expense of some delay in the first reporting of a track.

Once several updates have been received, the track is confirmed and displayed to the operator. The target tracking algorithm include the methods such as different kind of Filters (e.g. linear, nonlinear , particle filters etc).

DETECTION

The standard architecture for a detection and tracking system may be considered to have three high level functional blocks: sensors, signal processing, detection and tracking. The first function is the collection of sensor data over time. The signal processing function accepts sensor data as input. It interrogates the computed sensor data observation space for the presence of potential targets and produces measurements at potential target detection locations over time as output. This process may be thresholding of energy peaks.

Detection method is done by searching on the reflected pulses from the target to determine whether or the target is present or not. The target is determined when the reflected signal strength is greater than the threshold. Otherwise the target is absent. The raw data intercept the noisy data to clutter the pulse modulation is shows the detection of the target location is given in the Faigure 1.2

If the signal amplitude is below the threshold it is assumed to be interfernece signals.If it sis above the threshold it is asumed to be stronger signal due to presence of target .The "clutter + target " signals might represent the received signal strenght versus range (fast time) for a transmitted pulse.

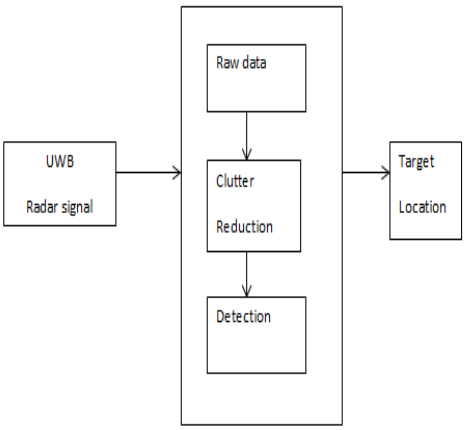

Fig 1.1 Detection of The Target With The Clutter Removal

ALGORITHM

The detection of target location and range can be calculated by the following

1. Input : waveform shape of the object v(t) and detection threshold

2. Initialize: initial residue waveform $d_0(t) = w(t)$ scan i =0

3. Signal detection : Compute cross – correlation with TOA and path magnitude

   Backscattering : subtraction of stationary clutter .
4. Increment the iteration counter i= i+1

5. Residual waveform updated w_s

6. Hypothesis testing H_0 = no target

   H_1 = presence of target
   P_D= probability of detection
   P_{FA}= probabaility of false alarm
   $P_{FA} = P_z (z|H_0)dz$
4. Signal Detection: Compute cross correlation r_{vd} between v(t)
5. Time index associated to the maximum range
6. Magnitude of the r_{vd} is the i^{th} estimated TOA and residual waveform to detect the target range
7. Next : iterate the process

RANGE ESTIMATION FOR LOCATION

Multiple targets range is measured by side lobes using the Target Masking . The smaller targets are visible above the sides of the lobes. When multiple moving objects exist within the UWB radar's range, the return signal must be segmented in time to isolate the scatters associated with individual moving objects, and analyzed by the human detector. Compared with Doppler radar, UWB radar can effectively resolve multiple targets by range gating, even without an array antenna, since a UWB signal has much wider RF Gabor (RMS) bandwidth than a Doppler radar signal. RMS range spread and hypothesis testing and beam can detect the range .

IV EXPERIMENT RESULT

Result analysis is the final stage of the project, which deals with the performance of the UWB – IR radar. They receive signals provide the date of targets present in the environment.

First the signal of the desired bandwidth in ultra wide band range was generated. Operating with the frequency the targets were detected and the range and location were extracted out of the system.

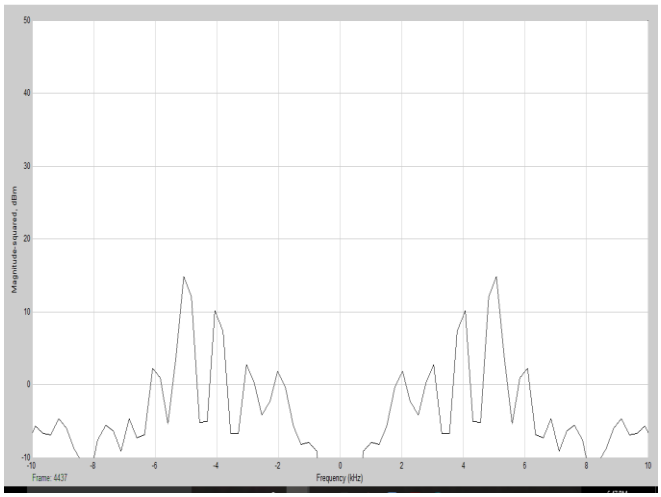

Fig 2.1 Targets Detection From Receive Signal

The Receive signal obtained from the UWB radar shows the detection of the target and the elimination of the stationary object are done. In Figure 2.2 shows the target detection and its movement of the object.

Gui design for tracking of UWB radar with the antenna connected signal the detection algorithm and the received signals based on the frequncy of the radar
Tracks the signals of the target and distinguish the noise and clutter removal.

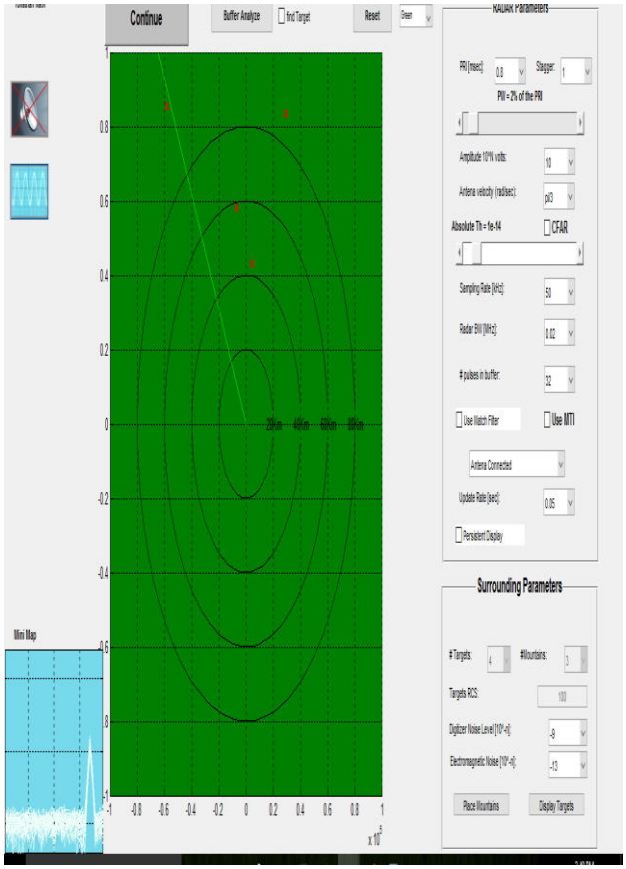

Fig 2.2 Uwb Tracking And Detection Algorithm Based On Signal

1. Pulse Repetition Interval and the number of different intervals . The PRI is the average time spent between each radar pulse transmission. The PRI defines the radar maximum range and the overall energy hitting a target.
2. Pulse Width – defined as a fraction of the PRI and sets the transmission duty cycle.
3. Transmitted Amplitude – The radar transmission power.
4. Antenna Velocity – The antenna turn velocity in radians.
5. Detection Threshold – works in Constant False Alarm Rate (threshold is set relative to reception level) or with a fixed threshold level. In both modes you can change the scroll bar to achieve the desired sensitivity level (it's good to be a little in the noise level).
6. The radar sampling rate – Defines the radar range cell size and directly affects the simulation real-time performance.
7. Radar Band Width – The reception Band Width, determines the shape of the received signal and the amount of electromagnetic noise in the receiver.
8. Number of pulses in the radar's buffer, the radar analyzes reception every of pulses.
9. Moving Target Indicator – Activate phase analysis in frequency plane to distinguish moving targets from stationary ones (and estimate its relative velocity to the radar).
10. Use a Match filter on received signal.
11. Which type of antenna is connected (disconnect the antenna to estimate the digitizer noise).
12. The radar displays update time.

V RESULT ANALYSIS

The result analysis of Uwb radar for detection and range of the target depends on the uwb threshold range.

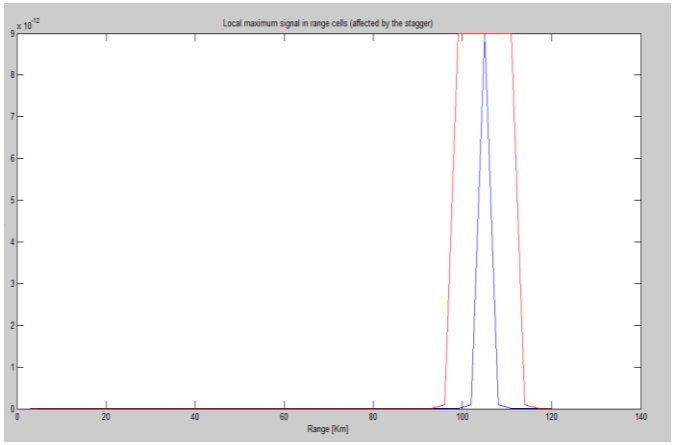

Fig 2.3 Range of the target

VI CONCLUSION

The Detection, localization and tracking of moving targets are the biggest challenges in IR-UWB radar-signal processing are that the received signals are deteriorated by the target distance, material and shape. The signal receive may create large errors when estimating target positions. In this project, the problem of through the wall tracking of moving persons is done by UWB-IR. The multiple moving person localization and tracking is done with target tracking algorithm. The implementation of real time UWB-IR radar to detect the

human targets, elimination of clutter and location of the target will be identified. Thus, this tracking algorithm and range estimation help to monitor the people useful in biomedical and for the elderly people who are live lonely life and helps in easy rescue in times of emergency. It can be also useful in biometric medical application and military application

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