Wi-vi Technology-a Review

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Abstract: —**Wi-Fi is a popular technology which allows an electronic device to connect to the internet wirelessly using radio waves. Wi-Fi signals are nothing but the information carriers between transmitter and receiver. Wireless Vision (Wi-Vi) is a new technology similar to the same concept of Wi-Fi which enables seeing through walls with the help of Wi-Fi signals. Wi-Vi allows us to track moving humans through walls as well as behind closed doors. Wi-Vi's operation does not require any access to any device on the other side of the wall. Wi-Fi can also enable us to see moving objects through walls and behind closed doors. So particularly, we can use such signals to identify the number of people in a closed room and their relative locations also.**

***Keywords*: Gesture-Based User Interface, MIMO, Seeing Through Walls, Wireless.**

I. INTRODUCTION:

This paper gives the idea about the potential of using Wi-Fi signals. There are recent advances in MIMO communications to build a device or a system that can capture the motion of humans behind a wall or door and in closed room. Law enforcement personnel can use this device to avoid walking into a scupper and minimize casualties in hostage situations. Emergency responders can be using it to see through the collapsed structures or debris. The advantages of this for ordinary users are the device for gaming, usurpation detection, privacy-enhanced monitoring of children, elderly or personal security when stepping into dark lanes and unknown places. The concept of this seeing through opaque obstacles is similar to sonar andradar

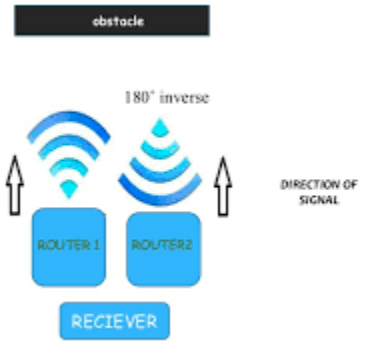


Fig 1

Wi-Fi signals are typically information carrier signals between a transmitter and receiver. Now it is possible with the Wi-Fi signals can also extend our senses [1]. They enable us to see moving objects through walls as well as behind the closed doors. So it is possible with the help of such signals to identify the number of people room and their relative locations in a closed room. We can also identify gestures made behind a wall and combine the sequence of gestures to communicate messages or commands to a wireless receiver without carrying any type of transmitting device. Wi-Vi means "Wi-Fi" and "Vision" which is nothing but wireless vision. It's a new promising technology that enables seeing through walls using Wi-Fi signals. It also allows us to track moving objects or human through closed rooms and behind the wall. Wi-Vi based on capturing the reflections of its own transmitted signals off moving objects behind a wall or door in order to track them. Wi-Vi operation does not require any access to any device on the other side of the wall. Specifically, when it is interact with a non-metallic wall, some form of

the RF signal would traverse the wall; reflect off objects and humans. It comes back with a signature of what is inside a closed room. By capturing these reflections, it is possible to image objects behind a wall or door.

Building a Device or system that can such reflections is difficult because the signal power after penetrating the wall twice (in and out of the wall) is reduced by three to five times of magnitude. Even the difficult challenge is the reflections from the wall itself, which is stronger than the reflections from objects inside the room.

II. RELATED WORK:

Wireless Vision i.e. Wi-Vi is related to past work in major three a

A:-Through Wall Radar:

There is growing interest in through-wall imaging for about a decade. Earlier work in this area focused on the simulations and modeling. Recently, there are some design implementations tested with moving humans. These past design of systems or devices eliminate the flash effect by doing isolation of the signal reflected off the wall from signals reflected off objects behind the wall. This isolation can be achieved in the time domain with the help of very short pulses (less than 1ns). Where the pulse reflected off the wall arrives earlier in time than that reflected off moving objects behind it due to the distance travelled. It can also be achieved in the frequency domain by using a linear frequency chirp signal given by L. Kempel, E. Rothwell, C. Coleman, G. Charvat and E. Mokole et al in 2010. In this scenario, reflections off objects at different distances come with different tones. By doing analog filtering the tone that corresponds to the wall, one can remove the flash effect. These techniques require ultra-wide bandwidths (UWB) of only few MHz of bandwidth and operates in the same range which is required for Wi-Fi. This technology removes the flash effect by leveraging MIMO nulling so it does not require UWB. Researchers have recognized the limitations of UWB systems. They also describe the capacity of using narrowband radars for through wall caused by moving objects behind the wall and door. However, the flash effect affects on the detection capabilities. Hence, most of the systems are demonstrated either in simulation, modeling or in free space with no obstruction. Wi-Vi has the objectives of these devices. It gives a new method for eliminating the flash effect without wideband transmission. This enables to work with concrete walls, solid wood doors and also fully closed rooms. The attempt which we are aware of that uses Wi-Fi signals in order to see through walls was made in 2012. This system needs both the transmitter and reference receiver to be inside the imaged room. Then, the reference receiver has to be connected to the same clock as the receiver outside the room and Wi-Vi can operate through-wall imaging without any access to any device on the other side of the wall.

Fig 2

Wi-Vi technology is different from the above systems. In that Wi-Vi, it requires

B. Gesture-based interfaces:-

Today's commercial gesture recognition systems such as the Nintendo Wii, Xbox Kinect, etc. can identify a wide variety of gestures. The academic community is also

developed some systems capable of identifying human gestures either by using cameras or by placing sensors on the human body. Recent work has also leveraged narrowband signals in the 2.4 GHz range to identify human activities in line-of-sight using micro-Doppler signatures [1]. Wi-Vi technology presents the first gesture-based interface that works in non-line-of-sight scenarios, and also through a wall. This technology does not require the human to carry any wireless device or to wear a set of sensors. whose wavelengths are nearly 12.5 cm3. In (a), an antenna array is able to locate an object by steering its beam spatially. In (b), the moving object itself emulates an antenna array; so from this fact it acts as an inverse synthetic aperture.

C. Infrared and thermal imaging:-

Similar to Wi-Vi, these technologies develop the human vision beyond the visible electromagnetic range. It also allows us to detect objects in the smoke or in the dark.

Fig1. A Moving Object as an Antenna Array

They operate by capturing or collecting infrared or thermal energy reflected off the first obstacle in line-of-sight of their sensors. However, cameras based on these technologies cannot see through walls because they have very short wavelengths in few μm to sub-mm, whereas Wi-Vi which employs signals whose wavelengths are

nearly 12.5 cm3. In (a), an antenna array is able to locate an object by steering its beam spatially. In (b), the moving object itself emulates an antenna array; so from this fact it acts as an inverse synthetic aperture.

III. WI-VI OVERVIEW:-

Wi-Vi technology is a wireless device that captures moving objects behind a wall and door. Wi-Vi has the strategic advantage of Wi-Fi to make through wall imaging relatively low cost, low power, low-bandwidth, and accessible to average users. Wi-Vi uses the Wi-Fi OFDM signals in the ISM band i.e. at 2.4 GHz and typical Wi-Fi hardware. Wi-Vi is basically a 3-antenna MIMO device in which two antennas are used for transmitting and one is for receiving. This also includes directional antennas to focus on the energy toward the wall or room of interest. Its design includes two main components:

1) The first component is used to eliminate the flash reflected off the wall by performing MIMO nulling.

2) The second component is used to tracks the moving object by treating the object itself as an antenna array using a technique called inverse SAR i.e. ISAR. Wi-Vi can be used in one of above two modes. It depends on the user's choice.

IV. ELIMINATING THE FLASH:-

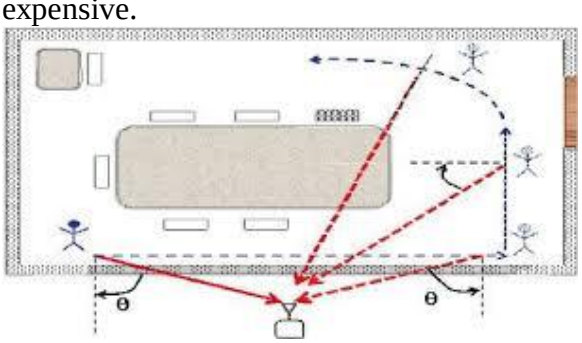
In every through-wall system, the signal reflected off the wall which is nothing but the flash, is much stronger than any signal reflected from objects behind the wall. This is due to the attenuation which electromagnetic signals suffer when penetrating through the dense obstacles. Table 1 shows some of the examples of the one-way attenuation experienced by Wi-Fi signals in construction materials. For example- once the signal is traversed through solid wood door or interior hollow wall, the Wi-Fi signal power is reduced by 6dB and 9dB. As mirrored signal on each the reflection constant because the cross-sectional of object owing to that the particular mirrored signal becomes weaker. Hence, Wi-Vi increases the sensitivity to the reflection of interest by victimization the development of nulling the interference or by power boosting.

V. . IDENTIFYING AND TRACKING HUMANS:-

Since, the elimination of the impact of static objects is described. So, now focus on moving objects as humans.

A. Tracking A Single Human:-

In advanced, through all systems antenna array is employed to trace the human motion. They steer the arrays beam to see the direction of most energy and this direction corresponds to the signals abstraction angle of arrival. By following that angle in time, it is possible to infer however the thing moves in area. However, Wi-Vi avoids using an antenna array for two reasons: First is in order to obtain a narrow beam that means achieve a good resolution, one needs a large antenna array with many antenna elements. This would result in a bulky and expensive device. Second is, since Wi-Vi eliminates the flash effect using MIMO nulling, adding multiple receive antennas would require nulling the signal at each of them. This requires adding more transmit antennas so the device will become bulkier and more expensive.



B. *Tracking Multiple Humans*

With multiple humans, the noise increases significantly. On one hand, each human is not just one object because of different body parts moving in a loosely coupled way and on the other hand, the signal reflected off all of these humans which are correlated in time, hence they all reflect the transmitted signal. The lack of independence between the reflected signals is important. For example, the reflections coming from two humans may combine systematically to dim each other for some period of time.

VI. THROUGH WALL GESTURE-BASED COMMUNICATION

Wi-Vi can enable a human who does not carry any wireless device to communicate short messages or commands to a receiver using simple gestures. Wi-Vi represents these try of gestures by „0" bit and „1" bit. These gestures are later composed by human to make messages that are having completely different interpretations. In addition, Wi-Vi will develop by exploitation different existing practices and principles like adding an easy code that may guarantee dependability, or by reserving an exact pattern of „0" and „1"s. At this stage this technology continues to be terribly basic, nevertheless we have a tendency to believe future advancement scan build it a lot of reliable and communicative.

VII. ADVANTAGES

First advantage is this system uses only one receiver still effectively measures the time it takes for the signals to reflect to calculated the exact location. Second is with low cost Wi-Fi technology system can be utilized in disaster recovery and gaming activities. And lastly Wi-Vi technology, as a gesture-based interface, does not require a line of sight between the user and the device.

CONCLUSION:-

We discussed Wi-Vi, a wireless technology that uses Wi- Fi signals to detect moving humans behind walls or doors and also in closed rooms. As compared to previous systems, which are targeted for the military, Wi-Vi enables the small cheap see-through-wall devices which operate in the ISM band, rendering them feasible to the general public. Wi-Vi also builds a communication channel between a human behind a wall or in a closed room and device itself, allowing person to communicate directly with Wi-Vi without carrying any of transmitting device. We believe that Wi-Vi has a set of functionality that future Wireless networks will provide. Future Wi-Fi networks will likely expand beyond communications and deliver facilities such as indoor localization, sensing as well as control. Wi-Vi gives evidence of advanced form of Wi- Fi-based sensing and localization by using Wi-Fi to track humans behind wall without carrying any wireless device.

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