APPLICATION INTERFACE TO IMAGE AND TRACK LIVE MOVEMENTS OF OBJECTS INSIDE THE WALLS

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ABSTRACT

One of the most well liked and widely used technique in building construction and renovation is that the NON-DESTRUCTIVE TECHNIQUE(NDT). The NDT permits engineers, plumbers, electricians offer an improved output while not inflicting harm to the property. Therein this reduces damage cost. The NDT method is not cost effective and it is not affordable by local plumbers, electricians, and customary people. The ULTRAWIDE BAND (UWB) sensor will be interfaced with mobile, that permits us to detect pipes, wires and studs. The interface is much cost-effective and simply usable by any individual. This device with interface is developed to assist people uncover hidden things within the world around them. The technology relies on 3D imaging sensors that use radio frequency to envision through solid surfaces. The device can be used by people worldwide, across a range of industries from construction, medical, automotive, smart home, retail, robotics and more. The application and the principle are safe, mobile, effective, and affordable devices to help improve health, security and quality of life. The technology wants to create a sophisticated In-Wall Imaging device which can see through walls to detect what's behind – from pipes to metal and wood studs, and even motion – ensuring less damaging, less expensive remodeling projects and renovations.

Keyword: *-Non- Destructive, Radio frequency, Ultrawide band, Application interface, Antenna array.*

1. INTRODUCTION

Tasks such as finding studs and locating plumbing required a combination of good luck, good ears, and basic construction knowledge. The wall scanners can be of kinds. Most of them mostly rely on the magnetometers that simply sense the presence of metals and some others use Earth magnets which can be used to detect the nails, screws, metal pipes and metal studs. With these scanners there are still possibilities to drill through the water pipes and even the live electric wires. This device is based on 3D imaging technology that use radio frequency, rather than a camera, to see through solid surfaces and create a visual image of what's inside. We hereby apply the application of the user to detect the objects inside the walls using the technology of 3D sensor that breaks through the known barriers and captures them. The device senses the environment by transmitting, receiving and recording signals from multiple antennas. The broadband recordings from multiple transceiver antenna pairs are analyzed to reconstruct a three-dimensional image of the environment. Analysis of sequences of images allows detecting changes in the environment. The device is capable of short-range imaging into dielectric environments, such as drywall and concrete.

2. EXISTING SYSTEM

Most of the existing system for through wall imaging is composed of several complex technologies and calculations which is very difficult to understand by ordinary people. The existing system uses the Synthetic-Aperture Radar (SAR) or Probabilistic SAR(PSAR) methodologies to see through walls which are actually very complex. Moreover, these existing systems are not always cost convenient. Moreover, with these scanners there are still possibilities to drill through the water pipes and even the live electric wires. The proposed system uses very simple methods and it is designed to be more cost efficient.

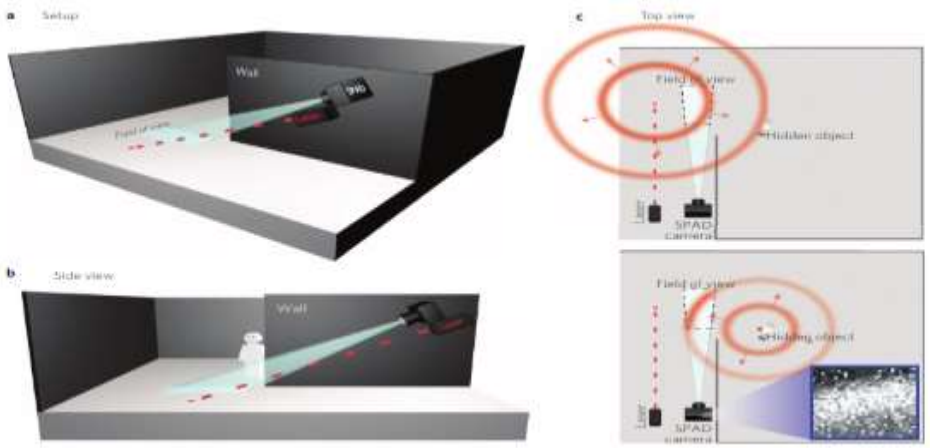

Fig-1: Existing working model

3. PROPOSED SYSTEM

The proposed system is focusing on the cost efficiency with enhanced features. The device utilizes radio frequency technology to sense the environment. An image of the environment is reconstructed using an array of linearly polarized broadband antennas to transmit, receive, and record signals. The data is processed and sent through a USB cable to a host device. The host device can be your computer or even a smartphone. It uses an antenna array to illuminate the area in front of it, and sense the returning signals. The data is communicated to a host device using a USB interface, which is implemented using Cypress controller. The sensor will begin calibrating. It is recommended to move the device slowly in a circular motion for this calibration. Once calibrated, try placing the material on the wall. Hardware device consisting of Ultrawide band sensor to detect and see through objects inside the walls. Ultrawide band sensor enables tracking of live-movements. An android application integrated with the hardware to enable the user to image the objects and tracking's inside the wall.

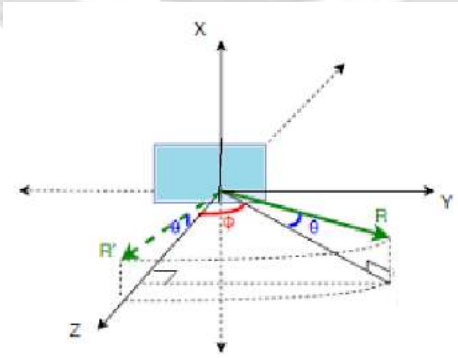

Fig-2: 3D Axial Diagram

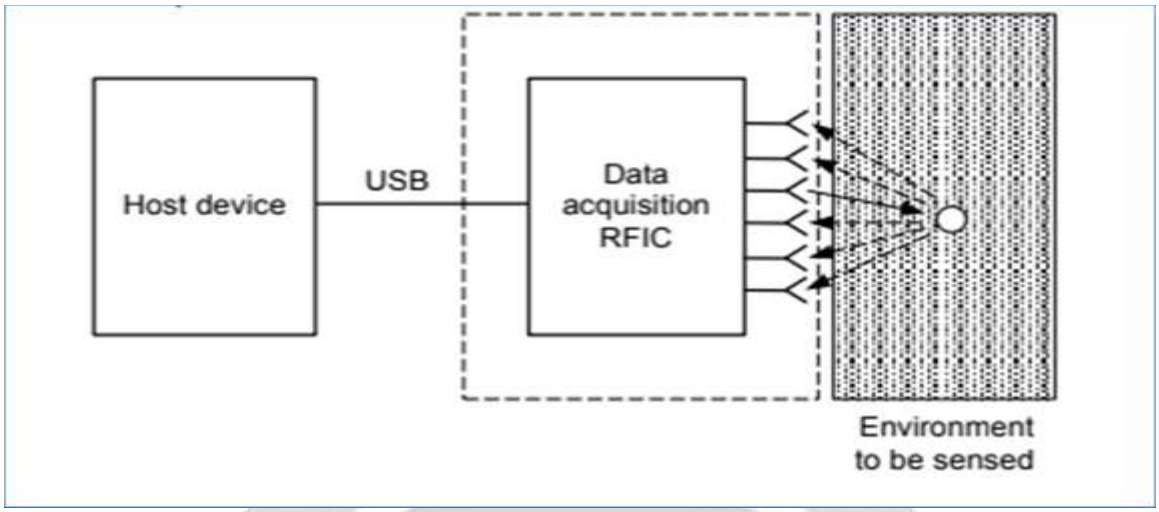

Fig-3: Architecture Diagram

4. SYSTEM HARDWARE AND SOFTWARE

The hardware modules consist of the ultrawideband radar sensor. This acts as the both transmitter and receiver. A short impulsive wave of low frequency and high bandwidth is sent against the wall. When there is any object or interference the sensor identifies the presence of object within the walls. The module main interface is USB, which is for communication, configuration and power supply to device. The onboard µUSB 2.0 connector supports USB 2.0 in High-Speed mode (480Mbit) and USB 3.0 in SuperSpeed mode. The device consists of two µUSB connectors – one is used for data transfer and possibly powering the device, and the other USB connector is for power only. The power source for the device is provided using the jumper on the back side.

The application interface is used to connect and disconnect with the hardware components. The important aspect of using application is to image the kind of object present within the walls. This can also be used to monitor the live moments of objects if any is present inside. The application provides simple user interface so that it is easily compatible and usable by every user.

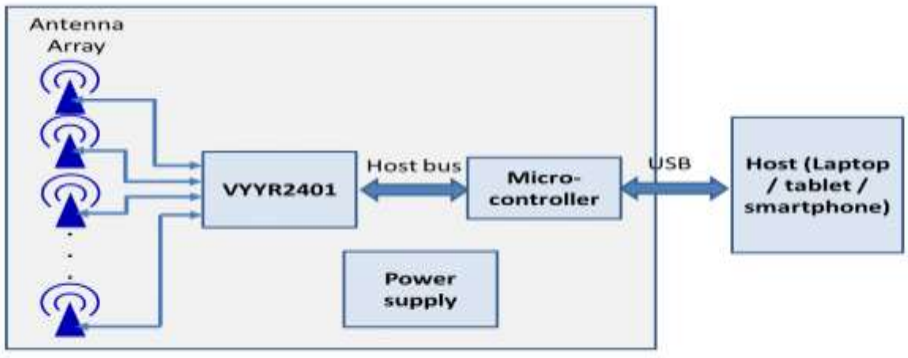

Fig-4: Detailed Diagram

5. WORKING

The device uses Radio Frequency (RF) technology to see into drywall/concrete walls to identify studs, pipes, wires, and live movements. It transmits Frequency Modulated Continuous Waves (FMCW) chirps and collect received signals by 2D antenna array. The frequency range of 3.3 – 10.3 GHz proving a huge bandwidth of 7GHz. It connects to your Android phone via USB cable and works through a dedicated application. The device initially starts working by calibrating with the wall surface and the mobile device to which it is connected. After calibration, the device starts sending radiations through the surface of the wall using the antenna arrays. The signals are produced and recorded by System-on-Chip integrated circuit. The data is communicated to a host device using a USB interface, The USB connection actually acts as both connectors as well it is the power supply to the device, which is controlled by a Cypress controller. The radiations that passes through the surface recognizes the objects behind the walls. These objects are then imaged with the help of the sensor.

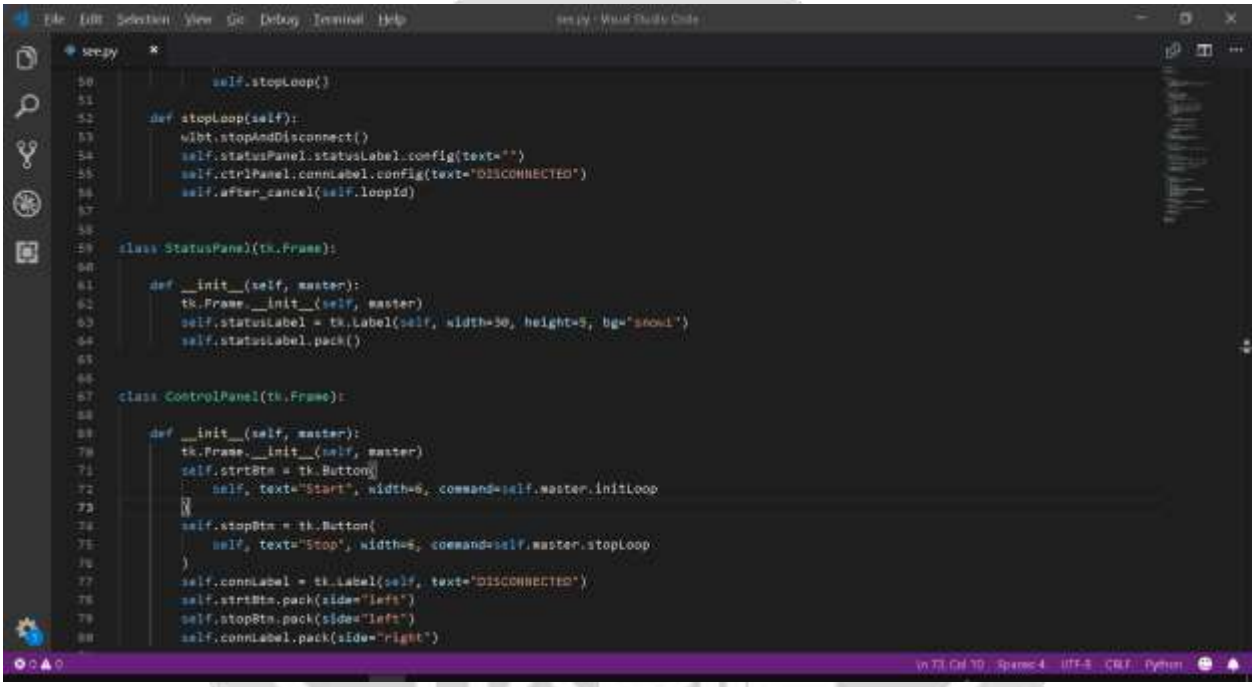

Fig-5: Implementation of Code

6. EXPERIMENTAL RESULTS

The results will be the images of the objects that are actually inside the walls which can be very useful for renovation purposes of the buildings. It can be used not to harm the pipelines, or cut the wires behind the walls during the drilling process.

Fig-6: Tested output for through wall imaging

7. APPLICATIONS

- In-room Imaging
- In-wall imaging
- Object detection, location and tracking
- Change detection
- Speed measurement

8. FUTURE WORK

In future work, we can focus on the techniques which ill be useful for the detection of human breathing and human motion. We may not be able to reconstruct the clear images of humans but further processing and clutter removal can bring a better image.

8. CONCLUSION

The device is very much useful for the renovations of buildings, to find a place to hammer nails. This device as it is simple and most cost efficient than the previous Non-destructive methods and it is easy to understand it is comparatively more efficient than the other previous models. We can be able to see through walls just like the X-ray vision.

9. REFERENCES

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