Experimental Results of UWB See-Through-Wall Radar Development

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See-Through-Wall (STW) imaging is one of the most promising applications of Ultra-Wide Band technology. Our developed STW is based on the transmission and reception of UWB pulses in the time domain using synthetic aperture radar (SAR). We developed a low-cost standalone real-time UWB STW experimental radar system (Yang, Y. and Fathy, A.E., Proc. IEEE MTT-S Int. Microwave Symp., 2007). Such system consists of off-the-shelf components along with customized keyed UWB time-domain data acquisition and beam-forming module.

The customized data acquisition and beam-forming module interfaces the developed UWB synthetic aperture array and a digital beam-forming processor (Yang Y., Zhang, C., Lin, S. and Fathy, Proc. IEEE AP Int. Symp., 2005). This implemented cost-effective data acquisition network uses a relatively low-speed commercial Analog-to-Digital converter, and Field-Programmable-Gate-Array (FGPA) board. The system logic control and image formation are implemented on FPGA board. The system is capable of developing 100 images per second and tracking real-time target movement trace, up to speed of 3 m/s, on a monitor screen, under an experimental environment. The developed system is an affordable practical platform for, not only STW application, but also related UWB applications such as indoor localization.

However, the resolution of see-through-wall imaging microwave radar systems is generally quite feeble, particularly in real-time scenario, where the allowed system responding time is very limited. But in an environment where real-time processing is less critical, utilizing computationally intensive imaging algorithms, large-aperture arrays, and correction on wall effect can significantly improve the images quality (G. Wang and M.G. Amin, IEEE Transaction on Signal Processing, Vol. 54, No.10, 2006). Such issues will be discussed in detail in our presentation.